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GASTROENTEROLOGY

ABSTRACTS AND CITATIONS

NATIONAL INSTITUTE OF ARTHRITIS, METABOLISM, AND DIGESTIVE DISEASES

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PREFACE

GASTROENTEROLOGY ABSTRACTS and CITATIONS is a publication of the National Institute of Arthritis, Metabolism and Digestive Diseases. This specialized information medium has been initiated to fill an existing great need in the field of gastroenterology and to assist the Institute in meeting its obligations to foster and support laboratory and clinical research into the nature, causes, and therapy of diseases of the gastrointestinal tract. Publication GASTROENTEROLOGY ABSTRACTS and CITATIONS makes available citations of all current papers relevant to this field from medical journals published throughout the world. Approximately one-third of the citations dealing with the major aspects of gastroenterology have accompanying abstracts.

The issuing of GASTROENTEROLOGY ABSTRACTS and CITATIONS under the auspices of the National Institute of Arthritis, Metabolism, and Digestive Diseases will provide a much needed current awareness tool to scientists and will facilitate greater integration of research and clinical efforts in this field. The number and great diversity of publications in the area of gastroenterology makes it imperative that an appropriate service be available to investigators and practitioners so that they may be apprised of progress with a minimum of delay. Our aim is to provide the readers with a readily systematized compilation of current published work. The publication will provide the greatest usefulness if these interested investigators will contribute their ideas and comments for consideration whenever possible.

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NOTE

Journal names are abbreviated according to the list of abbreviations used by *Index Medicus*. For journals not covered by *Index Medicus*, the abbreviations (with some modifications) found in *World Medical Periodicals*, 3rd Edition, are used.

LANGUAGE ABBREVIATIONS

Afr.	Afrikaans	It.	Italian
Ar.	Arabic	Jap.	Japanese
Bul.	Bulgarian	Kor.	Korean
Ch.	Chinese	Latv.	Latvian
Cz.	Czech	Lith.	Lithuanian
Dan.	Danish	Nor.	Norwegian
Dut.	Dutch	Pol.	Polish
E.	English	Por.	Portuguese
Eston.	Estonian	Rum.	Rumanian
Fin.	Finnish	Rus.	Russian
Fl.	Flemish	Ser.	Serbo-Croatian
Fr.	French	Sl.	Slovak
Ger.	German	Sp.	Spanish
Gr.	Greek	Sw.	Swedish
Heb.	Hebrew	Th.	Thai
Hun.	Hungarian	Turk.	Turkish
Ic.	Icelandic	Uk.	Ukrainian
In.	Indonesian	Viet.	Vietnamese

ABBREVIATIONS USED IN ABSTRACTS

ACTH	adrenocorticotropic hormone	mm	millimeter(s)
ADP	adenosine diphosphate	mOsm	milliosmolar; milliosmeter(s)
AMP	adenosine monophosphate	msec	millisecond(s)
amp	ampere	mV	millivolt(s)
ATP	adenosine triphosphate	min	minute(s)
Å	angstrom	MTD	maximum tolerated dose
BSP	sulfobromophthalein	NAD	nicotanamide adenine dinucleotide
C	degrees centigrade	NADH	reduced nicotanamide adenine dinucleotide
cal	calories	NADP	nicotanamide adenine dinucleotidephosphate
cc	cubic centimeter	NAPH	reduced nicotanamide adenine dinucleotidephosphate
cm	centimeter(s)	ng	nanogram (10^{-9})
dl	deciliter	nm	nanometer(s)
DNA	deoxyribonucleic acid	Pa	ambient pressure
ED_{50}	median effective dose(s)	PAS	periodic acid — Schiff
EDTA	ethylenediamine tetraacetic acid	pg	picogram (10^{-12})
e.g.	for example	pgEq	picogram equivalent(s)
EEG	electroencephalogram	p.o.	orally
ESR	erythrocyte sedimentation rate	ppb	parts per billion
g	gram(s)	ppm	parts per million
µg	microgram(s)	r	Roentgen
Hz	Herz	RBC	red blood cells (erythrocytes), red blood count
hr	hour(s)	resp.	respectively
i.m.	intramuscular	RNA	ribonucleic acid
i.p.	intraperitoneal	s.c.	subcutaneous
IU	international unit(s)	sec	second(s)
i.v.	intravenous	SGOT	serum glutamic-oxalacetic transaminase
kcal	kilocalorie(s)	SGPT	serum glutamic-pyruvic transaminase
kg	kilogram(s)	U	unit(s)
K_m	Michaelis constant	UV	ultraviolet
LD_{50}	median lethal dose(s)	V	volt
LDH	lactic acid dehydrogenase	WBC	white blood cells (leukocytes), white blood count
m	meter(s)	yr	year(s)
M	molar; mole(s)		
mM	millimolar; millimole(s)		
µM	micromolar; micromole(s)		
ma	milliampere(s)		
mCi, µCi	milli-, microcurie(s)		
mEq	milliequivalent(s)		
mg	milligram(s)		
ml, µl	milli-, microliter(s)		

PRE-CLINICAL SCIENCES

MORPHOLOGY, CELLULAR STRUCTURE AND HISTOCHEMISTRY

2400 POSSIBLE CELLULAR LOCALIZATION OF CHOLECYSTOKININ-PANCREOZYMIN. *(E.)* Kubes, L.; Jirasek, K. (Fac. Hosp. Charles Univ., Hradec Kralove, Czechoslovakia). *Experientia* 30(8):961-963, 1974.

Cellular localization of cholecystokinin-pancreozymin was investigated by introducing 15 ml of 127 mM solution (pH 7) of L-phenylalanine (a stimulator of cholecystokinin-pancreozymin secretion) into the duodenum of three anesthetized adult dogs. Samples of duodenal mucosa were taken 15 min after phenylalanine administration in two dogs and after 20 min in one dog. The samples were fixed in 5% glutaraldehyde buffered at pH 7.4, postfixed with 1% OsO_4, and embedded in Vestopal W. Ultrathin sections were stained with uranyl acetate and lead citrate and examined by electron microscope. Enterochromaffin cells were visualized throughout the whole gastrointestinal mucosa from the cardia to the large intestine. D type endocrine cells were also stimulated by the administration of phenylalanine and were seen in the gastrointestinal mucosa from the fundus, where they are sparse, to the opening of the small intestine, with maximum occurrence at the upper part of the duodenum. Their secretion granules were rounded, ranging in size from 160-400 nm. None of the other endocrine cell types were stimulated by phenylalanine administration. The hormonal product of the D type cells has not yet been identified, but the localization of these cells, with their greatest occurence in the duodenum, corresponds to the site of cholecystokinin-pancreozymin secretion as well as to motilin localization. It is suggested that cholecystokinin-pancreozymin rather than motilin is secreted by the D cells because motilin is released under alkaline conditions whereas the D cells are stimulated under acidic conditions.

2401 DIRECT QUANTITATIVE ESTIMATION OF PANETH AND TOTAL CELL POPULATIONS IN THE JEJUNAL GLANDS OF LIEBERKUHN. *(E.)* Malinin, G. I. (Dep. Biol., Georgetown Univ., Washington, D.C.). *Am. J. Anat.* 142(2):201-204, 1975.

Direct morphometric estimation of the number of intestinal crypts/10 mm length of jejunum, the total number of cells/crypt, and the number of Paneth cells/crypt, was performed using Zenker-fixed, serially sectioned small intestines from 12 adult BALB/c mice. The intestinal segments were serially sectioned 5 μ thick and stained with hematoxylin and eosin. The sections were cut using longitudinal and transverse planes of orientation, and measurement of intestinal structures made with stage and ocular micrometers. The mean volume of a crypt cell was estimated to be in the order of 6.6×10^{-4} mm^3, while the total volume of all cells in a single crypt was 1.833×10^{-1} mm^3. The cell population/crypt was 278 cells, of which 44 were Paneth cells. It was further estimated that 265 crypts/10 mm length of jejunum contained 7.4×10^4 cells, including 1.2×10^3 Paneth cells. The volume of all crypt and Paneth cells/10 mm length of jejunum was in the order of 49 and 8 mm^3, resp. The volume of the tunica muscularis and the surface area of the crypt's lumina were estimated to be 33.5 mm^3 and 118 mm^2, resp. Most of the data reported in this study were derived from 2 basic determinations: estimates of cell population/crypt and the number of crypts/U length of the intestine. The validity of numerical values presented is determined by the nature of the assumptions made concerning cell dimensions and arrangements and cell packing effects and by the accuracy of microscopic observations. The reliability of the microscopic observations was insured by a large number of measurements and reasonably small deviation from the mean. The excellent agreement between previously published estimates of the number of crypt cells and the number estimated using this method is taken as evidence that the assumptions made were valid ones. It is concluded, therefore, that the adopted methodological approach allows valid quantitative estimates of the intestinal crypt cell populations.

2402 HISTOCHEMICAL AND ULTRASTRUCTURAL CHARACTERIZATION OF A NEW TYPE OF ENDOCRINE CELL IN THE COLONIC MUCOSA OF THE RABBIT. *(Fr.)* Pradal, G.; Lefranc, G.; Tusques, J.; L'Hermite, A. (Fac. Med., Nantes, France). *J. Microsc. (Paris)* 19(2):129-236, 1974.

Fragments of colonic mucosa were removed from pentobarbital sodium-anesthetized adult male and female rabbits, some of which had been given an injection of L-dopa (60-100 mg/kg) 1 hr previously. In contrast to serotonin-containing cells which showed yellow fluorescence with the technique of Falk and Hillarp, many small cells with a pale green fluorescence were detected, particularly at the bottom of the crypts of Lieberkuhn, in contact with the basal membrane. These green cells were argyrophilic when stained by the technique of Grimelius, but not with that of Sevier and Munger; they were not argentaffinic when stained by the technique of Fontana and Masson. The green fluorescence disappeared after treatment with sodium borohydride or HCl vapors, and the cells did not react with glyoxylic acid vapors. In rabbits given L-dopa, serotonin-containing cells retained their original properties while the pale green cells became more intensely fluorescent. This suggests that the pale green cells take up and decarboxylate L-dopa and store dopamine. Examination of colonic mucosa under the electron microscope revealed that the secretory granules in the green cells differed markedly from those in serotonin-containing cells. The granules were rounded, did not exceed 350 nm in diameter, varied in density, and were sometimes heterogeneous. Granules in the same cell could exist in different states of maturation.

2403 ORIGIN, DIFFERENTIATION AND RENEWAL OF THE FOUR MAIN EPITHELIAL CELL TYPES IN THE MOUSE SMALL INTESTINE. V. UNITARIAN THEORY OF THE

ORIGIN OF THE FOUR EPITHELIAL CELL TYPES. *(E.)* Cheng, H.; Leblond, C. P. (Dep. Anat., McGill Univ., Montreal, Canada). *Am. J. Anat.* 141(4):537-561, 1974.

Presumptive evidence that the 4 main differentiated cell types in the epithelium of the mouse small intestine (villus columnar, mucous, entero-endocrine, and Paneth cells) originate from the same precursor, the crypt-base columnar cell, was obtained in previous studies. This possibility was examined using an approach based on the observation that, after injection of 2 or 10 μCi of ^{3}H-thymidine, some crypt-base columnar cells contained a vacuole including recognizable nucleus and cytoplasm. This vacuole was interpreted as a phagosome resulting from the ingestion of a non-viable cell and was used as a marker to follow the evolution of crypt-base columnar cells. In normal male adult mice, a rare crypt-base columnar cell includes a large phagosome containing Paneth cell remnants. By 6 hr after injection of 2 μCi ^{3}H-thymidine/g body weight, a number of crypt-base columnar cells included a different type of phagosome containing labeled nucleus and granule-free cytoplasm, which is attributed to phagocytosis of a labeled crypt-base columnar cell killed by β-radiation from the incorporated ^{3}H-thymidine. By 12 hr after ^{3}H-thymidine injection, phagosomes appeared in partly differentiated mid-crypt columnar cells and oligomucous cells; by 18-24 hr, in fully differentiated columnar cells and in Paneth cells; and by 30 hr, in an entero-endocrine cell. Since phagosomes are first found in crypt-base columnar cells and only later in the 4 differentiated cell types, it is concluded that crypt-base columnar cells transform into cells of these 4 types, and therefore, behave as the stem cells of the epithelium. The findings of rare epithelial cells containing 2 different types of secretory material (either mucous globules and entero-endocrine granules or mucous globules and Paneth cell granules) confirms that the stem cells are multipotential. These findings support the unitarian theory of epithelial cell formation in the small intestine.

2404 ENZYMATIC, FUNCTIONAL AND ULTRASTRUCTURAL DEVELOPMENT OF THE EXOCRINE PANCREAS. II. THE HUMAN PANCREAS. *(E.)* Track, N. S.; Creutzfeldt, C.; Bokermann, M. (Dep. Med., Univ. Gottingen, Germany). *Comp. Biochem. Physiol.* [A] 51(1):95-100, 1975.

The enzymatic and ultrastructural development of human fetal, newborn and adult pancreas was studied. Low protease levels (in activity/g wet weight) were found in pancreatic tissue from fetuses 10-30 cm in crown-heel length. Values for chymotrypsin and trypsin were under 0.05 and 0.5 mU/mg protein, resp. Fetuses from 40 cm in length to term showed increased levels of these enzymes (1.0 and 6.0 mU/mg protein, resp.). In the newborn, resp. values rose to 2.0-6.0 and 25-275 mU/mg protein, and in the adult to 5.0 and 100 mU/ protein. α-Amylase was detected only in adult pancreas. Phospholipase A and lipase levels increased over the gestational period from 0.2 to 0.8 and from 1.0 to 18.0 mU/mg protein, resp. Newborn levels were 0.4-0.6 and 15.0 mU/mg protein, resp. Adult values were 2.4 and 100-130 mU/mg protein, resp. Lipase activity in the duodenum increased from 0.04 to 5.00 mU/mg protein during gestation, while in adults, values ranged from 100 to 260 mU/mg for basal secretion and 344 to 1430 mU/mg after cholecystokinin stimulation. Duodenal contents of a 23.0 cm fetus showed under immunoelectrophoresis one strongly staining, two medium staining, and three weakly staining precipitation arcs; the three stronger ones being tentatively identified as lipase, trypsin 1, and anionic chymotrypsin. No arcs were found with smaller fetuses, and a large number of strongly staining arcs were found with adult specimens. Neither enzyme activity nor any electrophoresis arcs were found in amniotic fluid. Electron microscopy showed pancreatic cells from 8.5 cm fetuses were mainly undifferentiated tubular cells with no zymogen granules and few free ribosomes. The 12.5 cm fetus showed an increase in ribosomes and the appearance of some rough endoplasmic reticulum. The 14.0 cm fetus showed active Golgi zones, increase in mitochondria, small zymogen granules, and small lysosome granules. The 15.0 fetus to the 19.0 cm fetuses showed gradual increase in cellular activity, enhanced activity of the rough endoplasmic reticulum, condensing vacuoles, and zymogen granules of varying shape and size. The 21.0 to 26.0 cm fetuses showed a greater number of pancreatic cells with increased cellular activity and zymogen granule content. The 32.0 fetus showed still more highly organized exocrine cells the zymogen granules increased in number and electron density, and ductular lumina containing electron opaque material. The adult cell contained a prominant rough endoplasmic reticulum, and Golgi apparatus, and abundant dense zymogen granules in the cell apex in a limiting membrane. It is concluded that the human fetus can release pancreatic enzymes to digest swallowed amniotic fluid, and the development of this ability correlates with ultrastructural events in the exocrine cells.

2405 INTRACISTERNAL INCLUSION BODIES INDUCED IN ANIMALS: THEIR TRANSFORMATION AND SIGNIFICANCE. *(E.)* Watari, N. (Nagoya City Univ. Med. Sch., Japan). *J. Electron Microsc. (Tokyo)* 23 (4):255-268, 1974.

Electron micrographic studies in the pancreas of a number of species under normal and stressful conditions is reported. Two groups of bats (*Myotis lucifugus*) were kept at temperatures of 10 C and 20 C, resp., for four weeks, and the second group was fed after arousal. All were sacrificed within 4-24 hr. Wistar rats were kept at 1 C for 40 days and sacrificed. Dogs were given 200 mg/kg alloxan i.v. and sacrificed after 1-24 hr. Mice (ddy strain) were continually given 1 ppm γ-benzene hexachloride in drinking water for 1-12 months, or were injected with 200-400 IU vitamin A semiweekly for 1-18 months, or with 100 mg vitamin E daily for 2 weeks. Carp (*Cyprinus carpio*) were injected with 19 g/kg of 50% glucose i.p. and sacrificed after 1-2 hr. A cat with cystic fibrosis was sacrificed. For controls, intact animals of the above species, plus guinea pig and yellow-tail fish (*Seriola quinqueradiata*) were

sacrificed. Pancreatic tissues of the animals were fixed in either 2.5% glutaraldehyde and 2% osmic acid, or in 1% osmic acid. Liver samples were also fixed in 1% osmic acid. Electron microscopy showed the population of cells containing the intracisternal inclusion bodies was low except in the exocrine pancreas of the rat after cold treatment, and of the normal guinea pig. The inclusion bodies were classified into six morphological types. A round granular type, electron dense, was found in a single form in guinea pig pancreatic acinar cells, and in a multiple form in post-hibernation bat pancreas, and mouse pancreas exocrine cells after vitamin A treatment. A multivesicular form with low electron density spherical bodies containing lower electron density vesicles was found in vitamin A-induced mouse hepatomas, and rarely in mouse hepatocytes exposed to γ-benzene hexachloride. A filamentous type resembling collagenous fibers was also found in the mouse hepatomas. A crystalline type, electron dense and rectangular, was observed in previous experiments, in rat pancreatic acinar cells, after chlorophenylalanine treatment. An irregular particular type with low electron density was found in hepatic cells of mice given vitamin E. A collodial type, very electron dense, consisted of three subtypes: a monocolloidal subtype (large spherical granules) found in islet B cells of intact carp; a multiconfigurational subtype found in the ganglion-like cells of carp pancreas 2 hr after glucose injection; and an arbor-like configuration subtype found in the anterior pituitary of marine teleosts kept in fresh water. It is suggested that these various inclusion bodies represent secretory substances retained in the endoplasmic reticulum when passage to the Golgi apparatus is inhibited.

2406 STUDIES ON THE DEPLETION AND ACCUMULATION OF MICROVILLI AND CHANGES IN THE TUBULOVESICULAR COMPARTMENT OF MOUSE PARIETAL CELLS IN RELATION TO GASTRIC ACID SECRETION. *(E.)* Ito, S.; Schofield, G. C. (Harvard Med. Sch., Boston, Mass.). *J. Cell Biol.* 63(2):364-382, 1974.

Parietal cell structure and function was studied by examining the cytological effects of insulin injection and reserpine administration in adult male Swiss-Webster mice. Differences in the range of forms among parietal cells of fasting *versus* fed mice were not striking, but cells with numerous tubules and vesicles were more common after fasting. Parietal cells showed a homogeneous appearance within 40 min after insulin (0.1-5 U/kg, i.p.) or pentagastrin (125 μg/kg) injections. These effects persisted for 2 hr. Cytoplasmic tubules were often completely depleted while there was a concomitant increase in both number and size of microvilli. Measurements of acid secretion in control animals and in animals treated with acid secretagogues indicated H^+ secretion contemporaneous with depletion of the cytoplasmic tubulovesicular membranes and with increase of the microvilli. Two sets of dose-dependent changes occurred in reserpine-treated fasting mice. In mice given low doses of reserpine (0.1-0.5 mg/kg, i.p.), parietal cells were similar in appearance to those in animals stimulated with insulin or pentagastrin. These changes occurred as early as 30 min after injection and persisted 5 hr. After administration of high doses of reserpine (5 mg/kg) changes opposite to those induced by insulin, pentagastrin, or low doses of reserpine were seen. Parietal cells accumulated cytoplasmic tubules and vesicles and had reduced numbers of microvilli 4 hr after injection which persisted for 24 hr. Sterological methods quantitated 10 different parietal cell components. Tracer studies with lanthanum revealed no continuity between tubules and the plasma membrane. There were, however, regions of close apposition between the tubulovesicular membranes and the cell membrane of the canaliculus, and instances where cytoplasmic tubules extended from the cell into the core of enlarged microvilli. These results support earlier findings that hydrogen ion release is associated with a reduction in the tubulovesicular membrane content of parietal cells and an increase in the area occupied by intracellular canaliculi and their microvilli. The results of this study suggest that a role for cytoplasmic tubules as reservoirs for the storage of a secretory product is unlikely. It is suggested that the dissolution of tubulovesicular membrane may be involved in some aspects of the reconstitution of new microvillous membrane. It seems probable that during secretion there is redistribution rather than complete loss of this membrane from the cells so that, during reconstitution of the tubules, some part of the membrane or membrane constituents is available for recycling.

2407 LIPOPROTEIN PARTICLES IN THE JEJUNAL MUCOSA OF FETAL RATS. *(E.)* Mak, K. M.; Trier, J. S. (Harvard Med. Sch., Boston, Mass.). *Dev. Biol.* 43(1):204-211, 1975.

Lipoprotein production was studied in the fetal rat small intestine. Forty-five fetuses from 15 timed pregnant Sprague-Dawley rats were obtained by laparotomy at gestational ages of 18-22 days. Segments of proximal jejunum were fixed in osmium tetroxide, stained with uranyl nitrate and saturated lead acetate, and examined by electron microscopy. Eighteen day fetal specimens showed no morphological evidence of lipoprotein, but 19 and 20 day specimens showed particles 250-500 Å in diameter in absorptive cells of the apical portions of developing villi. These corresponded in size, electron density, and intracellular location with adult very low density lipoprotein particles. The number of these particles was greatly increased in the 21 and 22 day fetuses, the diameters were from 500-800 Å, and were found mainly in the endoplasmic reticulum (in contrast to the particles from the 19-20 day specimens which were found mainly in the Golgi apparatus). It is concluded that fetal rat small intestine epithelium is capable of synthesizing lipoprotein particles.

2408 ELECTRONMICROSCOPIC STUDIES ON THE DIFFERENTIATION AND THE ONTOGENESIS OF GASTRIC EPITHELIUM CELLS OF RAT EMBRYO. *(E.)* Matsumoto, T. (no affil.). *Arch. Jpn. Chir.* 42(1):293-314, 1973.

The kinetics of growth and differentiation of rat gastroepithelial cells was studied by electron microscopy. Stomachs of embryonic and fetal rats *(Rattus norvegicus albus)* were excised and fixed in glutaraldehyde or osmium tetroxide, and stained in uranyl acetate and lead oxide. Development fell into 3 stages. The first, the plane stage, lasted from about 7-14 days of fetal age and was characterized by the first appearance of columnar cells, surface mucosal cells and cells possessing small granules among the undifferentiated cells. The undifferentiated cells at this point were distributed over the plane basal membrane in a monolayer. The gastric pit stage followed, lasting from 17-24 days of age. Urn-like arrangements of undifferentiated cells appeared and began to develop into gastric pits, containing mucous cells. Parietal cells and basal clear cells also began to appear. Finally, the stage of gastric chief gland formation lasted from birth to 28 days. During this time the chief cells and basal granular cells made their appearance. By 31 days after birth the gastric glands were similar to those of the adult.

2409 ENTEROCHROMAFFIN CELLS IN THE GUINEA PIG DIGESTIVE TUBE IN RELATION TO AGING. *(E.)* Gandalovicova, D. (Inst. Pharm. Biochem., Prague, Czechoslovakia). *Folia Morphol. (Praha)* 22(1):102-108, 1974.

The incidence of enterochromaffin cells in the stomach and small and large intestine was studied by the Masson-Hamperl argentaffin reaction and the diazo reaction in guinea pigs belonging to 4 age groups: 2 days, 60 days, 6 months, and 2 1/2 yr. The number of enterochromaffin cells was expressed as the count/1000 epithelial cells of the intestinal villi and the gastric and intestinal glands. The following results are presented in order of increasing age as defined by the four groups above. For the cardia, as determined by the argentaffin reaction, the incidence of enterochromaffin cells for the four age groups was 4.0, 11.7, 14.1, and 17.8. Also for the cardia, but determined by the diazo reaction, the incidence of enterochromaffin cells for the four age groups was 2.0, 7.8, 11.1, and 13.5. For the fundus, determined by the argentaffin reaction, the values were 2.31, 7.8, 8.9, and 11.1; determined by the diazo reaction, 0, 3.1, 2.5, and 2.8. For the pylorus determined by the argentaffin reaction, the values were 1.1, 2.9, 3.0, and 2.0; determined by the diazo reaction, 0, 0, 0, and 0. For the duodenum as determined by the argentaffin reaction, the values were 32.3, 35.9, 35.2, and 48.0; determined by the diazo reaction, 21.5, 24.0, 25.2, and 28.8. For the jejunum, as determined by the argentaffin reaction, the values were 17.5, 20.0, 21.7, and 27.6; determined by the diazo reaction, 7.8, 11.7, 12.0, and 15.0. For the ileum, determined by the argentaffin reaction, the values were 13.9, 16.1, 19.9, and 27.2; determined by the diazo reaction, 1.0, 3.5, 4.5, and 5.1. For the colon, determined by the argentaffin reaction, the values were 26.6, 17.7, 13.2, and 12.7; determined by the diazo reaction, 10.0, 3.3, 2.0, and 0.8. These results indicate that in practically all parts of the digestive tract, the enterochromaffin cell count rose from the group of guinea pigs aged 2 days to the group aged 2 1/2 yr, with the colon as an exception. The number of enterochromaffin cells visualized by the Masson-Hamperl silver impregnation method was larger than the number shown by the diazo reaction. Finally, it was concluded that the distribution of the enterochromaffin cells in the individual parts of the guinea pig digestive tract was, in general, similar in all age groups.

2410 TOPOGRAPHIC RELATIONS OF LYMPHATIC ENDOTHELIAL CELLS IN THE INITIAL LYMPHATIC OF THE INTESTINAL VILLUS. *(E.)* Collan, Y.; Kalima, T. V. (2nd Dep. Pathol., Univ. Helsinki, Finland). *Lymphology* 7(4):175-184, 1974.

Endothelial joint areas in the walls of initial lymphatics were studied with respect to morphology and interrelationships with each other. Specimens were taken from dilated and non-dilated lymphatics of 17 Sprague-Dawley rats and prepared for electron micrography. Dilation or non-dilation was produced by ligating the lymphatics at the base of the mesentery in 2 rats; venous stasis for 1, 10, or 20 min in 6 rats; 1 mg of papaverin administered i.v. in 2 rats; and the mesenteric veins opened for 5 min in 2 rats. There were 5 controls. Five serial sections were cut from 2 specimens with dilated lymphatics and open valves, 3 were from animals with venous stasis for 1 min, and 2 were from papaverin-treated animals. Each serial section had a light microscope section cut before and after the serial section. All sections were cut perpendicular to the intestinal villi at the central portion. Most joint areas contained 1-6 junctions which appeared to be zonulae adherentes. Joint areas were classified as simple (valve-like with 2 overlapping leaves) or complicated (containing more than 2 layers but no more than 2 cells, and having 1 or more cellular junctions). Simple joints were more common in dilated than compressed lymphatics. Serial sections showed that in both simple and complicated joints, closed areas sometimes changed to open ones, and that both joint types were mutually convertible to one another. It is concluded that variation of appearance of joint areas is due to both the natural structure of the lymphatic and its functional status.

2411 THE DEVELOPING HUMAN FETAL PANCREAS: AN ULTRASTRUCTURAL AND HISTOCHEMICAL STUDY WITH SPECIAL REFERENCE TO EXOCRINE CELLS. *(E.)* Laitio, M.; Lev, R.; Orlic, D. (Dep. Pathol., Univ. Turku, Finland). *J. Anat.* 117(3):619-634, 1974.

Zymogen granule production in human exocrine pancreas was studied during the middle trimester of fetal life, and the observations compared with corresponding adult pancreatic acinar organelles. For electron microscopy, fragments of pancreas were obtained from seven 9-20 week fetuses, fixed in glutaraldehyde, post-fixed in osmium tetroxide and stained with toluidine blue, lead citrate and uranyl acetate, or left un-

stained. For histoenzymatic studies, tissues from three 15-20 week fetuses were cryostat sectioned at 6-8 μm. Enzymes studied included: alkaline phosphatase, acid phosphatase, leucine aminopeptidase, non-specific esterase, and thiamine pyrophosphatase. In addition, paraffin sections of pancreas from twelve 12-35 week fetuses were studied for general morphology, protein, and neutral glycoproteins to determine the time of appearance of exocrine acini and zymogen granules. Electron microscopy revealed no acinar cells in the 9 week pancreas, but a few appeared at 12 weeks containing small zymogen-like granules. During the 12-19 week period, the number of small zymogen granules gradually increased but were restricted to the area between the Golgi cisternae and the apical membrane. The small zymogen-like granules gradually decreased in number at the same time. Histoenzymatic studies demonstrated that pancreatic duct epithelial surfaces were negative for alkaline phosphatase at all fetal ages, while pancreatic stroma endothelium was positive. Non-specific esterase and leucine aminopeptidase were found in particulate deposits in acinar cytoplasm of all age groups. Thiamine pyrophosphatase was found in punctate deposits in acinar cell supranuclear cytoplasm, and did not vary with age. Light microscopy showed exocrine acini at 14-16 weeks. These showed a progressive increase in number of zymogen granules and cytoplasmic basophilia with toluidine blue. Paraffin sections showed primitive exocrine acini at the end of the third fetal month, but significant numbers of granules were not found until the fifth month. It is concluded that acinar cells appear by 12 weeks and mature over the next two months.

2412 COMPLETE IDENTIFICATION OF ENDOCRINE CELLS IN THE GASTROINTESTINAL TRACT USING SEMI-THIN-THIN SECTIONS TO IDENTIFY MOTILIN CELLS IN HUMAN AND ANIMAL INTESTINE. *(E.)* Polak, J. M.; Pearse, A. G. E.; Heath, C. M. (R. Postgrad. Med. Sch., London, England). *Gut* 16(3):225-229, 1975.

The serial semithin-thin section technique was used to demonstrate association of gastrin with G cells for complete identification of motilin cells in the small intestine. Small fragments of duodenal and jejunal mucosa from man, pig and dog were fixed and sectioned. Successive (serial) sections were subjected to immunofluorescence, silver impregnation and electron microscopy, or silver impregnation and light microscopy. Of 128 blocks, 28 were immunofluorescent for motilin, and only 12 could be used for correlation between light and electron microscopy due to technical difficulties. However, immunofluorescent motilin cells were shown to be identified with electron micrograph cells containing the electron dense nonspherical granules generally associated with enterochromaffin cells. Light microscopy further confirmed this by showing the storage granules of the motilin cells to be argentaffin. It is concluded that the enterochromaffin cell is the source of motilin, and that this technique offers the best possibility of correlation between ultrastructural morphology and immunocytochemistry.

2413 IMMUNOCYTOCHEMICAL LOCALIZATION OF SUBSTANCE P IN MAMMALIAN INTESTINE. *(E.)* Pearse, A. G. E.; Polak, J. M. (R. Postgrad. Med. Sch., London, England). *Histochemistry* 41(4):373-375, 1975.

Fresh samples of small and large intestine from man, dog, pig, and baboon were freeze dried and fixed in a number of non-aldehyde fixatives. The tissues were then subjected to indirect immunofluorescence with antibodies to synthetic substance P, using as controls normal rabbit serum as the first layer, second layer alone, or first layer antiserum with synthetic substance P. The controls were all negative and immunoreactive substance P was demonstrated in the cell bodies and processes in the plexuses of Auerbach and Meissner. In addition, immunofluorescence was found in the cytoplasm of numerous basigranular endocrine cells in the intestinal mucosa of all 4 species, tentatively identified as enterochromaffin cells. It is concluded that the enterochromaffin cell is probably of neuro-ectodermal origin.

2414 THE NORMAL HUMAN ESOPHAGEAL MUCOSA: A HISTOLOGICAL REAPPRAISAL. *(E.)* Weinstein, W. M.; Bogoch, E. R.; Bowes, K. L. (Dep. Med., Univ. Alberta, Edmonton, Canada). *Gastroenterology* 68(1): 40-44, 1975.

In 19 asymptomatic subjects (18-47 yr old; 12 women and 6 men), a total of 95 mucosal suction biopsies were taken from multiple sites in the distal 10 cm of esophagus and examined for evidence of basal cell hyperplasia and elongated dermal papillae, features considered to be histological consequences of gastroesophageal reflux. Five of the 19 subjects had either a positive acid infusion test or an abnormal manometric study. In these 5 subjects, 7 of 25 biopsies (28%) were abnormal, whereas 29 of 70 (41%) biopsies were abnormal in the 14 subjects who had both a normal acid infusion test and manometry study. Features of basal cell hyperplasia and elongated dermal papillae were seen in 57% of the biopsies in the distal 2.5 cm of the esophagus and 19% of the biopsies above 2.5 cm. It is concluded that these histological criteria are unlikely to be of significant diagnostic value in a clinical setting when 1 or 2 biopsies are taken, even above the most distal 2.5 cm of esophagus.

2415 ARGENTAFFIN GRANULES IN ENDOCRINE CELLS IN HUMAN DUODENAL MUCOSA. *(E.)* Tateishi, R. (Cent. Adult Dis., Osaka, Japan). *Arch. Pathol.* 99 (4):220-224, 1975.

Ultracytochemical studies of the endocrine cells of human duodenal mucosa were made to correlate individual cell type with serotonin production. Tissues were obtained from 2 patients undergoing surgery for gastric carcinoma, fixed in glutaraldehyde, and subjected either to routine electron microscopy, or to electron microscopy after silver impregnation by either the argyrophil or argentaffin reactions. Normal electron microscopy divided the endocrine cells

into 3 types according to the size and shape of the secretion granules. The first type had numerous granules less than 200 mμ in diameter with round cores that were either homogeneous and electron dense, or finely granular. The second type had fewer granules; these varied from 70-400 mμ in diameter and were uniformly round. The third type had generally a lower number of granules than the first 2, and measured from 100-500 mμ in the shortest diameter. The cores were electron dense, and either round, oval, tear-drop, rod-like, or concave. The silver grains of both argyrophil and argentaffin reactions precipitated on the cores of the granules in all 3 groups. Staining reactions were classified from 1+ to 5+ to designate increasing intensity. The first type, with the numerous 200 mμ granules, and the second type varied from 3+ to 5+ with the argyrophil reaction, but only from 1+ to 3+ with the argentaffin reaction. The third type, with the pleomorphic granules, showed heavy precipitations of 4+ and 5+ with the argentaffin reaction, and 4+ with the argyrophil reaction. It is concluded that all morphologic types of duodenal mucosal endocrine cells are positive for both argyrophil and argentaffin reactions; morphologic differences in secretion granules do not reflect differences in chemical nature; and that all endocrine duodenal cells are identical with respect to serotonin metabolism.

2416 ATROPHY OF VILLI WITH HYPERTROPHY AND HYPERPLASIA OF PANETH CELLS IN ISOLATED (THIRY-VELLA) ILEAL LOOPS IN RABBITS. LIGHT-MICROSCOPIC STUDIES. *(E.)* Keren, D. F.; Elliott, H. L.; Brown, G. D.; Yardley, J. H. (Johns Hopkins Univ. Sch. Med., Baltimore, Md.). *Gastroenterology* 68(1): 83-93, 1975.

Thiry-Vella loops in albino rabbit ileum were prepared by a new technique and were studied for 18 hr to 49 days postisolation to determine morphological changes. Possible reversal of villus atrophy and other changes after reimplantation into the intestine or after repeated perfusion with nutrient substances were also investigated. Either 1 or 2 ileal segments, 10-15 cm long, were isolated by transecting the intestine at a point 30 cm proximal to the ileocecal valve. In the method used to create the Thiry-Vella loops, portions of Silastic tubing about 25 cm long were prepared with 3 circumferential beads of adhesive on the end of the tubing which was to receive the loop. One bead was placed at the end of the tubing, the second bead 0.5 cm proximal to the first, and the third bead (with attached 2.0 silk suture for anchoring the abdominal wall) 1 cm proximal to the second. Adhesive-prepared tubing ends were inserted in the ends of the isolated loop and the free ends were passed through a s.c. tunnel from the edge of the incision to the area of the scapulae where they were exteriorized through a 2-cm incision. In 18 animals with Thiry-Vella loops, the loops became grossly shortened after 14 days. Histologically, some shortening and blunting of villi was detectable as early as 4 days postisolation; with prolonged isolation the changes became marked. Reduction in epithelial cell height and in brush border thickness was noted, and goblet cells were increased somewhat in size and prominence. There was only slightly increased chronic inflammation in the mucosa and acute inflammation was uncommon, suggesting that mucosal injury was minimal. Mean epithelial mitotic indices for the crypts did not rise and were generally reduced. Hyperplasia and hypertrophy of Paneth cells associated with mitotic figures in Paneth cells accompanied the atrophic changes in the villi. Reimplantation of loops into the bowel 3 weeks after isolation led to complete reversal of all changes, including hyperplasia of Paneth cells. Regular perfusion of loops with a solution containing a large variety of nutrient substances failed to reverse the mucosal changes. It is concluded that atrophy of villi in isolated ileum of the rabbit occurs mainly because 1 or more substances contained in the chyme are needed to maintain normal mucosal architecture. These substances probably help regulate epithelial cell turnover and may well be endogenous in origin. Loss of substances in the chyme after loop isolation may also have led to Paneth cell hyperplasia or the Paneth cell changes and atrophy of villi may be related in a cause-and-effect manner.

2417 EFFECT OF HYPOTHYROIDISM ON QUANTITATIVE FEATURES OF LIVER CELLS AND THEIR NUCLEI: A MORPHOMETRIC AND CYTOPHOTOMETRIC STUDY OF RAT LIVER CELLS THREE WEEKS AFTER THYROIDECTOMY. *(Ger.)* Riede, U. N.; Schmitz, E.; Robausch, T.; Kiefer, G.; Grunholz, D.; Sandritter, W. (Pathol. Inst., Univ. Freiburg/Breisgau, Germany). *Beitr. Pathol.* 154(2): 140-160, 1975.

Thyroidectomies were performed on 15 male Wistar rats weighing 80 g; five sham-operated rats served as controls. After 21 days the rats were sacrificed and cytophotometric and morphometric studies were performed on their livers. In thyroidectomized rats, determination of the relative DNA contents showed that the ratio of diploid to tetraploid cells was 9:1, while in controls this ratio was 6:4. Thyroidectomy reduced the volumes of individual cells and their nuclei by half and doubled the volume of nucleoli. The average number of nucleoli/cell was 4 in both groups of rats. Thyroidectomy reduced the mitochondrial volume/nucleus by about 30% and decreased the number of mitochondria/nucleus by almost 50%. A 40% increase occurred in the area of the external membranes of the mitochondria, while the area of crista membranes/U mitochondrial volume decreased by 25%, the area of crista membranes/nucleus by 33%, and the number of mitochondrial granules/U mitochondrial volume by 50%. Thyroidectomy doubled the volume of peroxisomes and reduced the volume and number of peroxisomes/nucleus and the number of peroxisomes/U cytoplasm volume by about 25%. The volume of free ribosomes/nucleus decreased greatly. The relative volume of lysosomes/U volume of cytoplasm and nucleus decreased by 50%, while the number of lysosomes/nucleus and U volume of cytoplasm decreased by almost 90%. The volume of the rough endoplasmic reticulum decreased without any change occurring in the area of its membrane, suggesting that the lumen of each cisterna had narrowed. Similar changes have been observed in starvation. The relative volume of the smooth endoplasmic reticulum in-

creased relative to the cytoplasm but not relative to the nucleus. These changes are attributed to reduced cellular metabolism in hypothyroidism.

2418 LAPAROSCOPIC AND MORPHOLOGICAL ASPECTS OF SUPERFICIAL LYMPHATIC VESSELS IN THE LIVER. *(Ger.)* Meyer-Burg, J.; Mielke, F.; Arbeiter, G. (Steglitz Clin., Free Univ., Berlin, Germany). *Leber Magen Darm* 4(6):280-291, 1974.

After a review of the normal anatomy of lymphatics in the liver capsule, changes these vessels undergo in liver disease are described and methods for visualizing them are discussed. Superficial lymphatics can be seen in the normal liver at laparoscopy. Their absence is an indication of diffuse metastases in the liver of advanced cirrhosis. Apart from the upper and lower surfaces of the left and right convexities, lymphatics can also be observed in the falciform ligament of the liver and gallbladder wall. In fatty liver and acute and chronic hepatitis, lymph vessels are increased in number, dilated and, in some cases, filled with more fluid than in normal livers. In portal hypertension the volume of lymph is increased, but the cross-section of lymph vessels is reduced as a result of cirrhosis. Lymphangiectasis is observed in the capsules of cirrhotic livers but, in contrast to lymph vessels in the hepatoduodenal, falciform, and coronary ligaments, their walls are not hypertrophied. Stenosis and dilatation of the lymph vessels are observed in chronic aggressive hepatitis. As in animal experiments, when a dye was injected under pressure directly into lymphatics on the surface of the liver, if there was not enough albumin in the lymph to bind with the dye, the dye emerged from the lymph vessels after several minutes. If the emerging lymph cannot be absorbed, ascites starts to form. Lymph cysts, which are actually fliud-filled pseudocysts ranging in size from a pinhead to a cherry, are present in normal livers but occur in larger numbers in cirrhosis. In extrahepatic obstructive jaundice, lymph vessels are filled with a yellowish-green fluid at laparoscopy. This results from retrograde filling of the lymphatics with substances normally found in the bile. Similarly, RBC have been found in the lymph system in cirrhosis due to the development of lymphovenous or venolymphatic shunts. Lymph vessels in the capsule of the liver can be visualized by indirect injection of dyes into the splenic and hepatic veins or by direct injection of dyes, contrast media, or ^{198}Au into superficial lymphatic vessels in the liver. In contrast to animal studies, which showed that patent blue is excreted from the biliary tract in rats, this dye is excreted *via* the lymphatics in man. This difference is probably species specific. Direct injection of ^{198}Au into the superficial lymphatics to visualize the retroperitoneal space is not of great diagnostic value since scintigraphic resolution is poor.

2419 PRESENCE OF CELLS COMBINING FEATURES OF TWO DIFFERENT CELL TYPES IN THE COLONIC CRYPTS AND PYLORIC GLANDS OF THE MOUSE. *(E.)* Nabeyama, A. (Dep. Anat., McGill Univ., Montreal, Canada). *Am. J. Anat.* 142(4):471-484, 1975.

Cells combining features of two different cell types were found in the colonic crypts and pyloric glands of the mouse. Specimens of descending colon (1 cm above pelvic rim) and pyloric antrum (near duodenum) from Swiss albino mice were fixed in paraformaldehyde and glutaraldehyde, postfixed in osmium tetroxide, stained with uranyl acetate and lead hydroxide, and examined by electron microscope. The normal cell pattern in the colonic crypt base consisted of about 83% vacuolated cells (containing a few membrane bound, 0.8 μm wide spheroids enclosing some 5 nm thick threads and 7 nm particles); 13% mucous cells (containing a few membrane bound 0.8 m wide spheroid mucous globules packed with dense 8 nm dot-like particles); 4% entero-endocrine cells (containing relatively few spheroidal or irregular granules, 100-300 nm, and occasional bundles of filaments near the nucleus); and 0.5% caveolated cells (having long microvilli, prominent filaments, and deep surface invaginations). All were rich in free ribosomes and relatively poor in secretory material. However, occasional cells were found resembling the vacuolated cells but also containing entero-endocrine type granules. Other vacuolated-type cells were found containing mucous globules in addition to the normal vacuoles. These were rich in free ribosomes in both types only when the vacuoles predominated over the granules or mucous globules. The pyloric glands were composed of numerous mucous cells with a few entero-endocrine cells, and an occasional caveolated cell. However, cells were found containing both mucous globules and entero-endocrine type granules and filaments and abundant free ribosomes. Cells resembling caveolated cells were also found, that contained mucous globules. Scarcity of secretory material and abundance of free ribosomes are signs of cellular immaturity; therefore it is suggested that in the descending colon the vacuolated cells transform into either mucous or entero-endocrine cells, and in the pylorus the mucous cells transform into entero-endocrine cells or caveolated cells.

2420 ELECTRON MICROSCOPE STUDIES OF RAT LIVER AFTER ORAL ADMINISTRATION OF CHENODEOXYCHOLIC ACID. *(Ger.)* Leuschner, U.; Neuenfeldt, H. U. (Cent. Intern. Med., Johann Wolfgang Goethe Univ., Frankfurt/Main, Germany). *Z. Gastroenterol.* 13(1): 27-34, 1975.

To determine whether chenodeoxycholic acid (CDC) causes morphological changes in the liver, it was given to 5 groups of 5 young male Wistar rats each in doses of 20 mg/kg p.o. through a stomach tube every day for 5-60 days. Another group of 5 rats received 29 mg/kg CDC for 30 days and 60 mg/kg for 30 days. No ultrastructural changes were found in the livers of rats treated with CDC for 5 and 14 days. Of the 5 rats given CDC for 20 days, 2 had dilated bile capillaries and a decrease in the number of villi with an occasional increase in the smooth endoplasmic re-

ticulum and slight swelling of the mitochondria. Similar findings were observed in all 5 rats given CDC for 30 days. When CDC was administered for 60 days, light vacuoles, surrounded by a simple membrane, were found in all 5 rats; the contents of these vacuoles resembled those of the sinusoids. The vacuoles varied in size and were detected in all of the rats, but were not present in all of the cells. Tripling the dose of CDC had no effect on the findings. Invaginations of the sinusoidal cell membrane, which varied in size, and many cystic dilatations of the intercellular spaces suggest that the vacuoles might have formed by invagination of the external cell membrane.

2421 EPITHELIAL PROLIFERATION IN THE PROXIMAL GASTROINTESTINAL TRACT OF THE RABBIT. *(Ger.)* Strauss, P.; Koburg, E. (Clin. Otorhinolaryngol., Univ. Dusseldorf, Germany). *Arch. Otorhinolaryngol.* 208(1):49-59, 1974.

^{3}H-Labeled thymidine was administered i.v. or i.p. to rabbits 30 min to 96 hr before animals were sacrificed, and its incorporation into DNA was measured by autoradiography in the soft palate, upper and lower surface of the tongue, esophagus, and duodenum. In all tissues studied, the duration of mitosis (M) was 1.5 hr, and the duration of DNA synthesis (S), 8 hr (7 hr in the duodenum). Considerable variations were observed in the duration of the G_1 period and the time required for a cell to migrate between the germinative layer and the area adjoining the area of desquamation (T). The minimal duration of the G_2 period was limited to 30 min for all tissues studied. Each mitosis is assumed to result in the production of 2 f_1 cells which are equal in their ability to develop. Examination of the basal layer was sufficient to calculate the duration of the cell cycle C which ranged from 14.2 hr in the duodenum to 45 hr in the esophagus. If the percentage of ^{3}H-labeled cells is known, only the order of magnitude of the renewal time can be estimated.

2422 LYSIS OF LIVER CELLS CONTAINING ALCOHOLIC HYALIN BY NEUTROPHILIC GRANULOCYTES - AN ELECTRON MICROSCOPE STUDY. *(Ger.)* Rumpelt, H. J.; Thoenes, W. (Inst. Cytobiol. Cytopathol., Univ. Marburg/Lahn, Germany). *Verh. Deutsch. Ges. Pathol.* (57):247-251, 1973.

The lysis of hepatocytes with alcoholic hyalin by neutrophilic granulocytes was studied by electron microscopy in biopsy material from patients with alcoholic liver cirrhosis. Neutrophilic granulocytes were found to establish contact over a large surface with the plasma membrane of the hepatocyte without any conspicuous changes in the adjacent hepatocellular or granulocytic cytoplasm. Then, the contact surfaces show more or less extended membrane defects which involve either the hepatocellular membrane, or additionally also the granulocytic membrane. These defect sites are zones in which hepatocellular and granulocytic cytoplasms are mixed with each other. The hyalin material is subsequently released from the destroyed hepatocyte and into the sinusoid. The findings indicate the leukotactic character of hyalin-containing hepatocytes with yet closed cell membrane. Once a leukocyte wall is formed, the hepatocyte membrane, and often even the granulocyte membrane are dissolved, and the hyalin-containing hepatocyte undergoes cytolysis without any preliminary morphological signs of cell death.

2423 MORPHOLOGY AND MEASUREMENTS OF THE SMALL INTESTINE MUCOSA IN NORMAL CHILDREN. *(E.)* Toccalino, H.; Iovannitti, C.; Gallardo, F. (Profesor Alejandro Posadas Polyclin., Haedo, Argentina). *Acta Gastroenterol. Latinoam.* 6(1):43-46, 1974.

2424 DIRECT FOURFOLD MAGNIFIED IMAGE OF FINE-STRUCTURE FOR LARGE INTESTINE MUCOUS MEMBRANE. *(Jpn.)* Kunieda, T.; Fukutomi, Y.; Shibayama, M.; Ogushi, Y. (Med. Sch. Fifu Univ., Japan). *Jpn. J. Clin. Radiol.* (19):697-702, 1974.

2425 SOME ASPECTS OF MITOCHONDRIA HAVING A "SEPTUM". *(E.)* Wakabayashi, T.; Asano, M.; Kurono, C. (Nagoya City Univ. Med. Sch., Japan). *J. Electron Microsc. (Tokyo)* 23(4):247-254, 1974.

2426 THE LOCATION OF ALBUMIN IN HEPATOCYTES DURING MATURATION OF THE LIVER. *(Fr.)* Guillouzo, A.; Feldmann, G. (Beaujon Hosp., Clichy, France). *Biol. Gastroenterol. (Paris)* 7(4):334-335, 1974.

2427 ERYTHROBLAST ISLETS: ANATOMIC UNIT OF HEMATOPOIETIC TISSUE IN FETAL RAT LIVER. *(Fr.)* Nagel, J.; Billat, C. (Lab. Anim. Physiol., Fac. Sci., Reims, France). *Arch. Anat. Microsc. Morphol. Exp.* 63(2):147-162, 1974.

2428 ULTRASTRUCTURE OF BASAL CELL ADENOMA OF THE PAROTID GLAND. *(E.)* Gyorkey, F.; Min, K. W.; Sirbasku, D.; Gyorkey, P. (VA Hosp., Houston, Texas). *Lab. Invest.* 32(3):448, 1975.

2429 PRELIMINARY REPORT ON THE EFFECTS OF VAGOTOMY ON THE ULTRASTRUCTURE OF RAT PARIETAL CELLS. *(E.)* Helander, H. F. (Dep. Anat., Univ. Umea, Sweden). *Acta Hepatogastroenterol. (Stuttg.)* 22(1): 65, 1975.

2430 ENZYMATIC ALTERATIONS IN DEGENERATED AREAS OF THE INTESTINAL MUSCULATURE IN LABORATORY MICE. *(E.)* Mullink, J. W. M. A.; Kroes, R. (Cent. Inst. Breed. Lab. Anim., TNO, Zeist, Netherlands). *Beitr. Pathol.* 154(2):182-189, 1975.

2431 ASBESTOS FIBERS IN THE COLONIC WALL. *(E.)* Westlake, G. E. (Child. Hosp., San. Francisco, Calif.). *Environ. Health Perspect.* 9:227, 1974.

See also, 2456, 2519, 2523, 2532, 2575, 2660, 2786, 2800, 2802, 2803, 3113, 3766.

ABSORPTION-EXCRETION-TRANSPORT

2432 INCREASED INULIN ABSORPTION FROM THE CAT STOMACH EXPOSED TO ACETYLSALICYLIC ACID. *(E.)* Flemstrom, G.; Marsden, N. V. B. (Biomed. Cent., Univ. Uppsala, Sweden). *Acta Physiol. Scand.* 92(4): 517-525, 1974.

The absorption of the ^{14}C-labeled polysaccharide inulin from the stomach of the cat was studied to determine if molecular species sufficiently large to be antigenic could be absorbed from the gastric lumen after exposure to acetylsalicylic acid. Six ml of an isotonic solution containing 12.5 µCi inulin with 15 mM acetylsalicylic acid (pH 2.70, 86% unionized) were introduced into the stomach through a glass cannula in the pyloric wall. The experiment lasted 6 hr and the urine volume and ^{14}C activity were measured at hourly intervals. The absorbed inulin was rapidly excreted and accumulated in the urine in sufficient quantities for molecular weight distribution analysis. About 95% of the urinary inulin had a molecular weight greater than 2000 and only moderate molecular sieving of the instilled inulin (average molecular weight 5200) occurred. This suggests that larger molecular species than tested could be absorbed from the stomach. The instillation of ^{14}C-inulin in acetylsalicylic acid-free isotonic NaCl, however, also resulted in a smaller but significant inulin absorption. The latter was further considerably reduced if the inulin was not added together with the isotonic saline, but later (20 min) in a small liquid volume, suggesting that mere distension of the stomach causes a temporary increase of the permeability which, however, is much smaller than that after acetylsalicylic acid. The acetylsalicylic acid-induced increase in ^{14}C activity in the urine reached a maximum during the second hr after instillation and thereafter declined slowly. It is suggested that ^{14}C activity after the second hr is probably due to a reduction of the acetylsalicylic acid-induced permeability increase caused by the loss of acetylsalicylic acid from the lumen, that is, the acetylsalicylic acid effect is reversible. It is concluded that acetylsalicylic acid increases gastric absorption of saccharide molecules of a size previously reported to be sufficiently large to evoke immune reactions.

2433 ABSORPTION OF CARBOHYDRATES AND VITAMINS IN THE PRESERVED AND TRANSPLANTED SMALL INTESTINE. *(E.)* Toledo-Pereyra, L. H.; Simmons, R. L.; Najarian, J. S. (Dep. Surg., Univ. Minnesota, Minneapolis). *Am. J. Surg.* 129(2):192-197, 1975.

The absorptive ability of the entire small intestine of adult mongrel dogs of either sex for carbohydrates and vitamins was studied after preservation for 24 hr by hypothermic pulsatile perfusion and allotransplantation. After transplantation, azathioprine (5.0 mg/kg/day) was given i.v. for 3 days and then reduced to 2.5 mg/kg/day i.v. until death. P.o. alimentation was begun by the seventh postoperative day. Dogs receiving small intestine perfused for 24-hr survived a mean of 23.7 days. The main causes of death were cachexia, rejection, and intestinal obstruction. The body weight decreased gradually to values of 30.3% from the control weight at 4 weeks postgrafting; no regain in body weight was noted. Anemia and hypoproteinemia were also present. In dogs with perfused small intestine allografts the absorption of D-xylose was significantly impaired in the first 3 weeks after transplantation. An improvement in absorption values was observed at 5 weeks post grafting. The absorption of vitamin A was also reduced during the first week post transplantation, but lower normal limits were reached at 3 weeks after transplantation. Dogs that survived more than 5 weeks had normal absorption patterns of vitamin A. Absorption of vitamin B_{12} was not significantly altered after transplantation, always remaining within normal limits. Dogs in which intestinal allograft rejection developed had a progressive decrease in the intestinal absorption patterns. Intestinal denervation and the use of immunosuppressive drugs are factors that are involved in the impairment of absorption of small intestine allografts. The interruption of lymphatic drainage apparently does not play a significant role in the poor absorptive capacity of the transplanted intestine because lymphatic regeneration occurs in an average of 2-3 weeks after surgery when the functional capacity of the small intestine was still impaired.

2434 EFFECT OF SODIUM, MANNITOL, AND MAGNESIUM ON GLUCOSE, GALACTOSE, 3-O-METHYLGLUCOSE, AND FRUCTOSE ABSORPTION IN THE HUMAN ILEUM. *(E.)* Bieberdorf, F. A.; Morawski, S.; Fordtran, J. S. (Univ. Texas Southwest. Med. Sch., Dallas). *Gastroenterology* 68(1):58-66, 1975.

The kinetics of sugar absorption in the human ileum *in vivo* were studied in an effort to reconcile a discrepancy resulting from previous experimental findings, namely that active sugar absorption *in vitro* is absolutely dependent on the presence of Na ions on the luminal side of the mucosa but that previous *in vivo* studies in the ileum of rat, dog, and man have shown that active glucose absorption is almost as rapid from a Na-free mannitol solution as from a NaCl solution. Absorption of 3 actively transported sugars (glucose, galactose, and 3-O-methylglucose) having different apparent K_m values and of fructose

(absorbed by a separate carrier-mediated process) were measured in the human ileum in normal adults of both sexes, 21-45 yr old, using constant perfusion techniques. Perfusion solutions contained NaCl or Na substitutes and a sugar. Perfusion rate was 15 ml/min. Mannitol substitution for Na resulted in a slight reduction (23%) in the active absorption of glucose. Mg substitution for Na resulted in a greater depression (45%) of glucose absorption. The apparent K_m for glucose absorption was increased when Na was replaced by Mg, but the maximal absorptive rate (V_{max}) was not altered. Mg did not depress glucose absorption or the apparent K_m for glucose transport when Na was present in the perfusion solution. Neither Na removal nor Mg had any effect on fructose absorption. Absorption of galactose and 3-0-methylglucose (low affinity sugars for the glucose carrier) was reduced by about 40-50% when mannitol replaced Na, but Mg substitution for mannitol in a Na-free medium did not further depress absorption of these sugars. The following conclusions were reached: 1) part of the discrepancy between previous *in vitro* and *in vivo* experiments was due to the type of test sugar (glucose *versus* glucose analogue) and the solute used to replace Na in the luminal solution; 2) Mg is more effective than mannitol in reducing Na concentration at the glucose transport site on the brush border; 3) luminal Na ions have an important effect on active sugar absorption in the human small intestine *in vivo* as they do *in vitro*; 4) there is a component of active sugar absorption (about 1/2) which appears to be independent of luminal Na ions *in vivo*.

2435 THE EFFECT OF ANGIOTENSIN ON ISOSMOTIC FLUID ABSORPTION BY THE RABBIT GALL-BLADDER IN VITRO. *(E.)* Leyssac, P. P.; Kristensen, L. O.; Christensen, P.; Frederiksen, O. (Univ. Inst. Exp. Med., Copenhagen, Denmark). *Acta Physiol. Scand.* 92(4):508-516, 1974.

Evidence that angiotensin II inhibits net fluid transport by the gallbladder when applied to the serosal side was examined in further detail using the gallbladders of female white rabbits. Angiotensin inhibited net fluid transfer at serosal concentrations between 10^{-9}-10^{-8} M. Maximum inhibition (about 25%) was obtained at a concentration of 5×10^{-9} M. No significant effect was demonstrable at concentrations of 10^{-10} M or lower, and the effect disappeared at higher concentrations (10 and 20×10^{-9} M). The inhibitory effect was due to a depression of the unidirectional Na^+-efflux (from mucosal to serosal side); Na^+-influx (from serosal to mucosal side) was unaffected. Maximum effective doses of angiotensin had no effect on transepithelial potential difference; ohmic resistance increased slightly (about 10%). The inhibitory effect of angiotensin was significantly reduced by incubating gallbladders with indomethacin (10 µg/ml) which effectively blocks prostaglandin biosynthesis. Addition of indomethacin alone had no effect on either net fluid transfer rate, potential difference, or ohmic resistance. It is concluded that angiotensin inhibits isosmotic fluid transport in the gallbladder by an effect on the active component of the transfer process. The data suggest that the effect is indirect and mediated, in part at least, by release of endogenous prostaglandins, or alternatively that indomethacin might interfere with the angiotensin receptor.

2436 KINETICS OF TAUROCHOLATE UPTAKE BY THE PERFUSED RAT LIVER. *(E.)* Reichen, J.; Paumgartner, G. (Dep. Clin. Pharmacol., Univ. Bern, Switzerland). *Gastroenterology* 68(1):132-136, 1975.

The uptake of taurocholate by the perfused liver of male SPF rats of the Sprague-Dawley strain was studied by the multiple indicator dilution technique using single injections of ^{14}C-labeled taurocholate and ^{99m}Tc-labeled albumin. The livers were perfused *in situ* at a mean perfusion rate of 1.85 ml/min/g liver and at a mean perfusion pressure of 11.5 cm of H_2O. During each of 5 experiments, 3 to 6 doses (75 to 25,000 nM) Na taurocholate, each labeled with 4 nCi of Na taurocholate 24-^{14}C were given. Prior to administration, each dose of taurocholate was mixed with 10 µCi [^{99m}Tc]albumin in erythrocyte-free perfusion solution and injected rapidly in a constant volume of 0.21 ml into the portal vein cannula. Albumin and ^{51}Cr-labeled erythrocytes were injected together at the beginning and end of each experiment to determine the intra- and extravascular space of the liver. Total hepatic venous outflow was collected in 2-sec intervals. Taurocholate was distributed into an extravascular space equivalent to that of albumin. The taurocholate dilution curves appeared to be related to the albumin curves in a single exponential manner for the whole range of doses studied. Analysis of the dilution curves revealed that the initial taurocholate uptake rate increased with increasing taurocholate dose in a nonlinear fashion, exhibiting saturation kinetics which obeyed the Michaelis-Menten equation. The erythrocyte space was 15.8% of the liver weight and did not change significantly throughout one perfusion. The albumin and taurocholate space were 8.4 and 8.5% of the liver weight, resp., and did not differ significantly. The initial maximal uptake was found to be 32.5 nM/sec/g liver, a value exceeding the maximal steady state capacity for excretion of taurocholate into the bile. The half-saturation constant was 90.6 nM/g liver. It is concluded that this system is operating far from saturation at physiological levels of bile acids in portal blood. It is also suggested that taurocholate binds to some receptor or carrier of the hepatocyte but under the conditions of this experiment, it is not possible to differentiate between concentrative transport, facilitated transfer, or simple diffusion with subsequent binding to an intracellular receptor.

2437 STUDIES OF INTESTINAL ABSORPTION UNDER PATHOLOGICAL CONDITIONS. III. EXPERIMENTAL STUDIES OF GLUCOSE ABSORPTION DISORDER CAUSED BY SODIUM LAURYL SULFATE. *(E.)* Sugimura, F. (Nihon Univ. Sch. Med., Tokyo, Japan). *Nihon Univ. J. Med.* 16(2):173-189, 1974.

Glucose absorption through the intestinal wall of adult male white rabbits which had been damaged by exposure to 5% sodium lauryl sulfate solution was studied *in vivo* using a portal blood collecting tech-

nique. The lower small intestine was ligated at 2 sites 30 cm apart, after which a heparin-coated catheter was inserted into a relatively thick branch of the portal vein draining blood through small branches coming from a segment of the intestine between the 2 ligatures. The portal blood was collected in 5-min samples for the duration of each experiment. Ten ml of 5% glucose solution was injected into the lumen of the lower small intestine between the 2 ligatures by syringe in 5 normal rabbits and the portal blood collected every 5 min to estimate sugar level. In 2 of the 5 animals, the portal blood drained out continuously for a relatively long time, 80 and 105 min. The blood sugar level increased gradually and almost linearly for about 70 min after the injection and remained almost on the same level thereafter. When 10 ml of 5% glucose was injected into the lower small intestine 60 min after the injection of 10 ml of 5% sodium lauryl sulfate, glucose absorption through the intestinal wall rose linearly for the duration of the experiment (70 and 95 min, in 2 of 5 rabbits injected), indicating a pattern corresponding to passive diffusion. When 10 ml of 5% glucose containing an additional 5% sodium lauryl sulfate was injected into the lower small intestine, glucose absorption rose parabolically up to a definite height and thereafter remained on the same level in 2 of 5 rabbits (portal blood flow lasted for 60 and 120 min). It is concluded that sodium lauryl sulfate causes changes not only in the structure of the intestine but also in the mechanism of intestinal absorption. It is further concluded that the portal blood collecting method makes it feasible to study intestinal absorption under physiological conditions with minimum autolysis and no or mild tissue damage.

2438 HEPATOCELLULAR UPTAKE OF TAUROCHOLATE IN THE DOG. *(E.)* Glasinovic, J. C.; Dumont, M.; Duval, M.; Erlinger, S. (INSERM, Beaujon Hosp., Clichy, France). *J. Clin. Invest.* 55(2):419-426, 1975.

The uptake of taurocholate by the liver of the intact dog was studied by the multiple-indicator dilution method in 22 experiments involving eight dogs and the kinetic characteristics of the uptake process determined. ^{51}Cr-labeled RBC (vascular indicator), ^{125}I-labeled albumin (an extravascular reference), and [^{14}C]taurocholate were injected into the portal vein. Different doses of unlabeled taurocholate were included in the injection mixture which had a total volume of about 1 ml. Hepatic venous samples were taken every 2 sec from an outflow catheter; sampling rate ranged from 1.0-1.5 ml/sec. Two to four sets of dilution curves were obtained in the same animal, with an interval of at least 45 min. As a consequence of the hepatic uptake, the outflow recovery of [^{14}C]-taurocholate was much reduced when compared to that of albumin, but its recovery increased with increasing doses of taurocholate, suggesting a progressive saturation of the uptake process. The analysis of the dilution curves fitted a 3-compartment model system well. No return of the extracted taurocholate to the extracellular space could be detected. The initial space of distribution of taurocholate was 1.22 times greater than that of albumin. Analysis of the data for uptake was consistent with Michaelis-Menten kinetics. The calculated initial maximal velocity of uptake was 4.53 μM/sec/100 g liver and the dose yielding half-maximal velocity was 7.11 μM/100 g liver. The maximal velocity of uptake was about 6 times the known maximal capacity of biliary secretion of taurocholate in the dog. It is concluded that these results are consistent with the hypothesis that the uptake of taurocholate is carrier-mediated.

2439 CHANGES IN INTESTINAL ABSORPTION IN THE SWINE AFTER ACUTE IRRADIATION. *(Fr.)* Remy, J.; Daburon, F.; Villiers, P. A.; Chenut, M. C.; Nizza, P. (Lab. Appl. Radiobiol., At. Energy Comm., Jouy-en-Josas, France). *Strahlentherapie* 148 (1):95-106, 1974.

Two groups of 4 Pitman Moore pigs each, aged 8-15 months, were exposed to γ-radiation from ^{60}Co. Those weighing 25-50 kg were given only water for 15 hr before exposure to 1500 rads and were maintained on water until they died, while those weighing 20-35 kg were given only water for 15 hr before exposure to 800 rads and received water for 3 days after irradiation. Animals in the first group received no protection, while those in the 2nd group were partially protected by lead plates over the body from the xyphoid process of the sternum to the occipital crest, permitting survival of 6-8% active bone marrow. Except for 1 pig given infusions of amino acids, minerals, and vitamins 21 days after irradiation, no treatment was given to either group. Within 1 hr after irradiation with 1500 rads, glucose absorption decreased to 3%, Ca absorption to 4%, and Na absorption to 11.7% of preirradiation values. Except for glucose absorption, which increased on day 2, these decreases persisted at about the same level until day 4. Irradiation with 800 rads also reduced glucose, Na, and Ca absorption, but this decrease was not as great and did not occur until 2-4 days after irradiation. Na and glucose absorption tended to increase again 2 weeks after irradiation, but Ca absorption remained below normal for several months in 1 pig although blood Ca levels remained within normal limits throughout the experiment. While irradiation with 800 rads did not produce a gastrointestinal syndrome in the swine, growth was completely arrested in 1 of the pigs for 4 months as a result of malabsorption.

2440 A PROPOSED MECHANISM FOR ZINC ABSORPTION IN THE RAT. *(E.)* Evans, G. W.; Grace, C. I.; Votava, H. J. (Hum. Nutr. Lab., Agric. Res. Serv., US Dep. Agric., Grand Forks, N.D.). *Am. J. Physiol.* 228(2):501-505, 1975.

The uptake of zinc by the epithelial cell basolateral plasma membrane was studied, along with the effect of albumin on membrane-bound zinc. Labeled zinc was added to pancreatic secretions from a mongrel dog or to pancreatic supernatant from male Sprague-Dawley rats, after which zinc binding was measured. In other experiments, the whole-body absorption of ^{65}Zn was measured in rats in which the common bile duct or the

hepatic duct was ligated, and the effect of the pancreatic zinc-binding ligand on zinc uptake by the intestinal epithelial cells was examined using everted small intestinal segments. Both the dog pancreatic secretions and the rat pancreatic supernatant fraction contained a low-molecular-weight ligand which bound zinc. The whole-body absorption of ^{65}Zn in rats in which the common bile duct was ligated was significantly less than that in normal animals or animals in which the hepatic bile duct had been ligated. Although jaundice was present in all ligated rats, it had no apparent effect on zinc absorption. When the zinc-binding ligand from the dog pancreatic secretions was added to a labeled buffer solution, the *in vitro* uptake by rat intestinal epithelial cells was significantly greater than that in buffer solution containing no ligand. Following *in vivo* labeling, 30% of the ^{65}Zn in the epithelial cells was associated with the partially purified basolateral plasma membrane. When labeled basolateral plasma membranes were incubated in a medium containing zinc-free albumin, approximately 96% of the ^{65}Zn was transferred to the medium; less than 30% of the isotope was released into media containing no albumin or a 3:1 zinc:albumin complex. In rats fed a zinc-deficient diet, ^{65}Zn absorption was inversely proportional to the serum zinc concentration, and both zinc and copper injections produced a marked decrease in ^{65}Zn absorption. These results suggest that zinc absorption consists of interactions among a low-molecular-weight ligand, receptor sites on the basolateral membrane, and metal-free albumin.

2441 BILIARY EXCRETION OF IODIPAMIDE. *(E.)* Loeb, P. M.; Berk, R. N.; Feld, G. K.; Wheeler, H. O. (San Diego Sch. Med., Univ. California, La Jolla). *Gastroenterology* 68(3):554-562, 1975.

The dose and rate of iodipamide necessary for optimal biliary excretion with the least risk of toxicity were investigated. Three adult mongrel dogs had cholecystectomies and Thomas cannulas inserted in the duodenum opposite the duodenal papilla. Indwelling Silastic catheters in both external jugular veins were used for blood collections and infusions. Dogs were fasted for 24 hr before bile collection, and 0.5 mg/kg of pipenzolate methylbromide were initially administered i.v. followed by a dose of 0.1 mg/kg every 20 min to minimize bile flow fluctuations. An i.v. infusion of 1.5% sodium taurocholate solution was given throughout to replace bile salts lost. When bile flow was constant, control samples of blood and bile were collected, and a 15.3% solution of methylglutamine iodipamide was infused at 7 increasing rates between 0.33 and 7.33 μm/min/kg. After 30 min at each rate a 3 ml sample of bile was collected, a blood sample was collected at the midpoint of each collecting period, and iodine concentrations of both were measured. In 2 experiments, urine was also collected, and its iodine concentration determined. When the infusion rate of iodipamide was increased stepwise from 0.33 to 4.0 μm/min/kg, the plasma concentration increased in a linear fashion from 0 to 0.83 μm/ml. At 7.33 μm/ml/kg, the plasma concentration rose at a slower rate. The rate of excretion and concentration of the drug in the bile increased markedly at lower plasma concentrations and began to plateau when the plasma concentration reached 0.4 to 0.6 μm/ml. As the iodipamide infusion rate was increased, biliary iodipamide excretion increased sharply up to an infusion rate of 2 μm/min/kg after which progressively smaller increments of the drug were excreted. The drug did not appear in the urine until the plasma concentration had reached 0.20 m/ml, after which the rate of excretion in the urine increased in a linear fashion. At a plasma concentration of 0.20 the ratio of biliary to urinary excretion was 14, while at a plasma concentration of 0.60 the ratio was less than 2. When a steady state of plasma concentration and biliary excretion was reached at each constant iodipamide infusion rate, the total excretion rate of the drug in bile and urine was less than the rate of infusion. The excretory deficit increased as the plasma concentration increased. It is concluded that by slow infusion, high plasma concentrations could be avoided, and the smallest dose necessary for radiographic visualization could be given.

2442 THE EXSORPTION CHARACTERISTICS OF VARIOUS SUGARS. *(E.)* Axon, A. T. R.; Creamer, B. (St. Thomas' Hosp., London, England). *Gut* 16(2):99-104, 1975.

The exsorption patterns of glucose, galactose, xylose, mannose, and lactulose from rabbit plasma to intestinal lumen were compared. Each sugar was injected *via* external cannula into the jugular vein in a solution containing 1 g of creatinine. After a 15-min equilibration period, intestinal perfusate was collected for a 10-min period and the concentrations of the test substance in the plasma and perfusate were determined using quantitative paper chromatography. With lactulose, mannose, and xylose, there was a direct relationship between exsorption rate and plasma concentration. The intestinal clearance of xylose was significantly greater than that of mannose or lactose; the latter two did not differ significantly in this respect. At low concentrations there appeared to be a barrier preventing glucose and galactose from reaching the lumen; virtually no exsorption took place until the plasma concentration reached 50 μM/ml, and even at 100 μM/ml exsorption was slow. When the plasma concentration was increased, however, the exsorption rate increased considerably. Phlorizin (10^{-2} M) completely abolished the mucosal barrier to glucose; luminal glucose (140 μM/ml) had a similar effect on galactose exsorption. 2,4-Dinitrophenol had no effect on the exsorption of glucose, and removal of sodium from the luminal perfusate had no effect on galactose exsorption. The data suggest that there are two barriers which prevent actively absorbed monosaccharides from passing from plasma to lumen: an anatomical one which restricts all large water-soluble molecules to some extent; and a specific barrier which is related to the active absorption mechanism.

2443 INFLUENCE OF DEHYDROCHOLATE AND TAUROCHOLATE ON BROMSULPHTHALEIN UPTAKE, STORAGE,

AND EXCRETION IN THE DOG. *(E.)* Delage, Y.; Erlinger, S.; Duval, M.; Benhamou, J. P. (INSERM, Beaujon Hosp., Clichy, France). *Gut* 16(2):105-108, 1975.

The influence of dehydrocholate on bromsulphthalein relative-storage capacity, biliary transport maximum, and fractional transfer rates between plasma, liver, and bile were studied in unanesthetized mongrel dogs. In six dogs, storage capacity, biliary transport maximum, and fractional transfer rates from plasma to liver, liver to bile, and liver to plasma were measured during 0.15 M NaCl infusion. The measurements were repeated under a dehydrocholate infusion of 95 µM/min, an infusion rate approaching the known biliary transport maximum of bile salts. The storage capacity and fractional transfer rates from plasma to liver were significantly lower during dehydrocholate infusions (18 mg/mg/100 ml and 0.120 mg/mg/min, resp.) than during NaCl infusions (47 mg/mg/100 ml and 0.280 mg/mg/min, resp.). The transport maximums and fractional transfer rates from liver to bile were also significantly lower during dehydrocholate infusions (3.2 mg/min and 0.013 mg/mg/min, resp.) than during NaCl infusions (4.8 mg/min and 0.033 mg/min, resp.). In three additional experiments, taurocholate had similar effects to those of dehydrocholate on storage capacity and transport maximum. These findings suggest that competition occurred between the bile salts and bromsulphthalein from hepatic uptake and storage. They support the hypothesis that the decreased disappearance rate and relative storage capacity of bromsulphthalein observed during biliary obstruction may be due to competition between bile salts and bromsulphthalein for hepatic uptake and storage.

2444 EFFECT OF DIETARY LACTOSE ON THE ABSORPTION OF PROTEIN, FAT AND CALCIUM IN THE POST-WEANING RAT. *(E.)* Leichter, J.; Tolensky, A. F. (Div. Hum. Nutr., Sch. Home Econ., Univ. British Columbia, Vancouver, Canada). *Am. J. Clin. Nutr.* 28(3):238-241, 1975.

The effect of different dietary levels of lactose on the excretion of protein, fat, and calcium was studied in the postweaning rat, which has a low level of intestinal lactase activity. Young male Sprague-Dawley rats were maintained for 13 days on diets containing 10% lactose, 30% lactose, 10% sucrose, or 30% sucrose. Food intake, weight gain, and the fecal and urinary excretion of protein, nitrogen, and calcium were monitored over the last 10 days. The 30% lactose group showed the lowest food intake, lowest weight gain, and lowest food efficiency. The urine volume in the two lactose groups was significantly higher than in the sucrose groups. The fecal fat and nitrogen excretions were also significantly higher in the lactose groups, but the fecal calcium was lower in the lactose groups; the latter difference was significant only in the case of the 30% lactose group. The lactose and sucrose groups did not differ significantly in urinary nitrogen excretion, but urinary calcium excretion was significantly higher in the 30% lactose group. These findings suggest that dietary lactose may reduce the absorption of protein and fat, but not of calcium, in individuals with low levels of intestinal lactase activity.

2445 INTESTINAL TRANSPORT OF TRYPTOPHAN AND ITS ANALOGS. *(E.)* Bosin, T. R.; Hathaway, D. R.; Maickel, R. P. (Med. Sci. Program, Indiana Univ., Bloomington). *Am. J. Physiol.* 228(2):496-500, 1975.

The role of the indole nucleus in the active intestinal transport of tryptophan and its 1-methylindole and benzo(b)thiophene analogs was studied *in vitro* in the rat and hamster. Everted intestinal sacs prepared from adult male Sprague-Dawley rats and adult male golden hamsters were filled with test solutions containing tritium-labeled D,L-tryptophan or one of its analogs. Both tryptophan and tryptophan-benzo(b)thiophene were actively transported across the intestinal tissues, while tryptophan-1-methylindole was not actively transported. There was no significant difference between the K_m and maximal transport velocity (V_{max}) values or between, resp., K_m and V_{max} values of the former two when compared between rat and hamster. Tryptophan transport in the rat was competitively inhibited in the presence of the benzo(b)thiophene analog, while the 1-methylindole analog was unable to inhibit tryptophan transport. The transport of tryptophan and its benzo(b)thiophene analog was depressed at high concentrations (10 M), and all three amino acids produced subtle alterations in the barrier properties of the intestinal sacs, as evidenced by increased tetraethylammonium [^{14}C]-bromide diffusion. The results indicate that tryptophan and its benzo(b)-thiophene analog share the same carrier and interact in a competitive fashion, while the 1-methylindole analog appears to be inert with respect to carrier interaction. The results also indicate the importance of the 1-position of the indole nucleus as a site for steric interaction of tryptophan with the carrier molecule.

2446 SITES OF ORGANIC ACID PRODUCTION AND ABSORPTION IN GASTROINTESTINAL TRACT OF THE PIG. *(E.)* Argenzio, R. A.; Southworth, M. (Dep. Physiol. Biochem. Pharmacol., New York State Vet. Coll., Cornell Univ., Ithaca). *Am. J. Physiol.* 228(2):454-460, 1974.

The effect of diet and time elapsed after feeding and the pH and production of volatile fatty acids in the gastrointestinal tract was studied in the pig. Growing pigs were maintained on a commercial diet containing 20% protein or on a high-cellulose, low-protein diet containing 3% protein and 3% urea. On the day of the experiment, the animals were killed 2, 4, 8, or 12 hr after the morning meal and the pH and volatile fatty acid content in their gastrointestinal tracts determined. In parallel studies, the *in vitro* absorption of volatile fatty acids was measured in samples of large intestinal and stomach mucosa from pigs on the commercial diet. In animals fed the control diet, the contents of the cranial half of the stomach showed marked, cyclic fluctua-

tions in pH and high concentrations of organic acids. The contents of the caudal (glandular) half were lower in both pH and organic acid concentration. Despite concentrations of volatile fatty acids as high as 250 mEq/liter in the large intestine, the pH remained relatively neutral. The volatile fatty acid levels remained relatively constant throughout the length of the colon. In the animals fed the low-protein, high-cellulose diet, there was no weight gain. The pH of the gastric and duodenal contents was lower and that of the remaining small and large intestinal contents was higher than in the controls. Concentrations of the volatile fatty acids in the gastric and large intestinal mucosa were considerably lower than in the controls. In the *in vitro* studies, all four types of gastric mucosa absorbed and transported volatile fatty acids at substantial rates, although the cecal and colonic mucosa transported these acids at much greater rates than the gastric mucosa, the equine large intestinal mucosa, or the bovine rumen epithelium. The results suggest that: 1) substantial amounts of carbohydrate undergo microbial digestion in the stomach and large intestine of pigs fed a high-concentrate growing ration; 2) the volatile fatty acids are readily absorbed and may provide an important source of energy; and 3) that the production and absorption of these fatty acids may have a major effect on the secretion and absorption of sodium and water by the large intestine.

2447 RESPONSE OF ACTIVE TRANSPORT OF IONS AND SPONTANEOUS WATER FLUX TO OSMOTIC GRADIENTS IN GASTRIC MUCOSA. *(E.)* Villegas, L. (Cent. Biophys. Biochem., Venezuelan Inst. Sci. Invest., Caracas). *Am. J. Physiol.* 228(3):738-741, 1975.

The effects of symmetric changes in the mucosal and serosal bathing solutions on cell water content, net ion flux, and net water movement were studied in the isolated frog gastric mucosa. Mucosas from *Rana pipiens* were bathed in hyposmotic (165 mOsm/kg water), buffered hyposmotic, isosmotic (226 mOsm/kg water), or hyperosmotic (286 mOsm/kg water) solutions. There was a linear correlation between cell water content in the mucosa and osmolality of the solutions. A similar correlation was found between cell water content and osmolality of the nutrient solution. While there was a significant correlation between the observed net water flux and osmolality, there was no significant correlation between the transmucosal potential difference and the osmolality of the solution. Similarly, acid secretion was significantly correlated with osmolality, but short-circuit current, transmucosal potential difference, and conductance were not. It is postulated that similar effects on spontaneous ion and water fluxes might occur if the tonicity were changed only at one surface rather than both. The data obtained question the validity of measuring transmucosal osmotic permeability without making appropriate corrections for the changes in spontaneous fluxes related to cell osmolality changes such as those observed in the absence of transmucosal osmotic gradients.

2448 STIMULATION OF ACTIVE AND PASSIVE SODIUM ABSORPTION BY SUGARS IN THE HUMAN JEJUNUM. *(E.)* Fordtran, J. S. (Univ. Texas Health Sci. Cent. Dallas, Southwest. Med. Sch.). *J. Clin. Invest.* 55 (4):728-737, 1975.

The effects of glucose and fructose on water and sodium absorption in the human jejunum were compared to assess the relative contributions of the active and passive sugar stimulation of sodium transport. The effect of fructose was assumed to be entirely passive, and the difference between the effects of fructose and glucose was assumed to be a measure of sugar-stimulated, active sodium absorption. Nine normal subjects were studied with the triple-lumen perfusion system; water and electrolyte movement with mannitol served as a base line for quantitating the effects of fructose and glucose. At 130 mM sugar, glucose and fructose stimulated water and sodium absorption equally/mM sugar absorbed. Under conditions where glucose and fructose were absorbed at approximately equal rates, the stimulated rates of water and sodium absorption/mM sugar absorbed were about 30% lower with fructose than with glucose. The two sugars stimulated chloride absorption to approximately the same extent and in proportion to the stimulated water and sodium absorption rates. Glucose, however, stimulated more chloride absorption/mM sugar absorbed than did fructose. Compared with fructose, glucose had a 20-30% greater effect on the absorption of urea. Glucose stimulated potassium secretion and fructose stimulated potassium absorption. Neither sugar significantly affected sodium movement when bicarbonate or sulfate, rather than chloride, was the major anion present in the perfusing solution. It is concluded that glucose stimulates passive and active sodium transport in the human jejunum. Stimulated active sodium absorption generates an electrical potential across the mucosa that causes sodium and potassium secretion and partly or completely nullifies the effect of active sodium transport on net sodium movement. Net sodium absorption stimulated by glucose is mainly the passive consequence of solvent flow. The accompanying anion determines the degree to which sugars stimulate sodium absorption. The effects of bicarbonate and sugars on jejunal sodium absorption are not additive.

2449 EFFECTS OF UNILATERAL SODIUM REPLACEMENT ON SUGAR TRANSPORT ACROSS IN VITRO RABBIT ILEUM. *(E.)* Rinaldo, J. E.; Jennings, B. L.; Frizzell, R. A.; Schultz, S. G. (Univ. Pittsburgh Sch. Med., Pa.). *Am. J. Physiol.* 228(3):854-860, 1975.

The effects of unilateral sodium replacement in the perfusion medium on the passive and active transport of 3-*O*-methyl-D-glucose across the isolated rabbit ileum were studied, using choline chloride and mannitol in place of sodium. Replacement of sodium in the serosal solution alone did not significantly affect the net passive movement of 3-*O*-methyl-D-glucose from the mucosal solution to the serosal solution. However, when sodium was replaced in the mucosal solution alone, the net passive absorption of 3-*O*-methyl-D-glucose did not differ significantly from that observed when both the mucosal and serosal solutions were rendered sodium-free. The results

with choline chloride were nearly identical with those obtained with mannitol. The presence or absence of sodium in the serosal solution did not significantly affect the rate of active 3-*O*-methyl-D-glucose absorption, while replacement of sodium in the mucosal solution inhibited sugar absorption. The results did not differ significantly when sodium was replaced with choline or mannitol. There was good agreement between the bi-directional fluxes of mannitol and 3-*O*-methyl-D-glucose when the mucosal solution alone was rendered sodium-free by replacement with choline. The results indicate that replacement of sodium in the mucosal solution alone essentially abolishes transcellular 3-*O*-methyl-D-glucose transport and that the remaining transepithelial fluxes are largely due to diffusion through the paracellular or shunt pathway.

2450 EFFECT OF ETHANOL INGESTION ON DUODENAL CALCIUM TRANSPORT. *(E.)* Krawitt, E. L. (Dep. Med., Univ. Vermont, Burlington). *Lab. Clin. Med.* 85(4):665-671, 1975.

The effect of ethanol and duodenal calcium transport and the concentrations of intestinal proteins was studied. Male albino rats were given 20% ethanol as the sole source of fluid for 12 days; in some cases the rats had been raised on a vitamin D-free diet. Vitamin D and 25-hydroxycholecalciferol were administered i.p. or intragastrically 24 hr before death. The chronic ingestion of ethanol resulted in a significant depression of calcium transport by everted duodenal gut sacs. The administration of vitamin D_2, D_3, or 25-hydroxycholecalciferol did not completely restore the ability of the gut sacs to transport calcium. In rats fed a vitamin D-deficient diet, ethanol did not affect the serosal:mucosal ratios when compared to vitamin D-deficient controls, nor did it interfere with the ability of pharmacologic doses of vitamin D to increase the rates of transport when given 24 hr before experimentation. Ethanol ingestion caused a decrease in the protein concentration in the duodenal 38,000 x g supernatant, but did not significantly affect the calcium-binding activity. Ethanol also depressed the activity of duodenal alkaline phosphatase; this activity was restored to normal levels by vitamin D administration 24 hr before death. Duodenal alkaline phosphatase activity was also depressed in starved, non-ethanol-treated rats. Ethanol ingestion did not significantly affect ATPase activity. The results suggest that ethanol interferes with calcium transport by a mechanism at least in part independent of the vitamin D pathway and that changes in alkaline phosphatase and calcium transport, although both affected by vitamin D, may represent independent metabolic consequences.

2451 THE ABSORPTION AND SUBSEQUENT UTILIZATION OF LECITHIN BY THE RAT JEJUNUM. *(E.)* Rodgers, J. B.; O'Brien, R. J.; Balint, J. A. (Dep. Med., Albany Med. Coll., NY). *Am. J. Dig. Dis.* 20 (3):208-213, 1975.

The utilization of luminal lecithin for the synthesis of microsomal and prochylomicron-chylomicron lecithin was studied during a period when the intestine was actively absorbing dietary lipid. Bile fistula male Sprague-Dawley rats were infused with a mixture of liquid diet, sodium taurocholate and lecithin at a rate of 2.4 ml/hr; bile salts and labeled lecithin were added to the liquid diet on the day of use. The animals were killed and samples of intestinal microsomes and intestinal prechylomicrons plus chylomicrons obtained. The specific activities of the isotopes in lecithin were determined using liquid scintillation spectrometry. After 1 hr, significant quantities of the three isotopes were present in the microsomal lecithin. Less radioactivity was recovered from the prechylomicron-chylomicron lecithin than from the microsomal lecithin, ^{32}P being particularly reduced in the former. Total recoveries of lecithin were much greater from the microsomal fraction (3.94 mg) than from the prechylomicron-chylomicron fraction (0.53 mg); thus, the specific activities of ^{3}H and ^{14}C were uniformly greater in the latter. The ratio of glycerol to palmitate in the microsomal and prechylomicron-chylomicron fractions was very similar to the ratio in the original lecithin, as was the glycerol:phosphate ratio in the microsomal fraction. The results indicate that luminal lysolecithin formed by the hydrolysis of lecithin by pancreatic phospholipase can be absorbed without further digestion and reutilized for mucosal lecithin synthesis. They also suggest that when sufficient lysolecithin is present in the intracellular compartment, the major pathway for lecithin synthesis is *via* acylation of this substrate, and that the major role of lysolecithin absorbed from the intestinal lumen after lecithin digestion is for lipoprotein production.

2452 REGULATION OF INTESTINAL CALCIUM-BINDING PROTEIN BY CALCIUM INTAKE IN THE RAT. *(E.)* Freund, T.; Bronner, F. (Univ. Connecticut Health Cent., Farmington). *Am. J. Physiol.* 228(3):861-869, 1975.

The effect of dietary intake on the rat intestinal calcium-binding protein was studied. Male Sprague-Dawley rats were maintained on semisynthetic diets containing 0.06% calcium and 0.2% phosphorus, 1.5% calcium and 1.5% phosphorus, 0.5% calcium and 0.5% phosphorus, or 1.5% calcium and 0.2% phosphorus. All diets contained 2,200 IU/kg vitamin D_2. In addition, some animals were maintained on diets similar to the latter two, but with no added vitamin D_2. The calcium-binding protein of the intestinal mucosa of these animals was assayed using analytical gel electrophoresis. The binding capacity of the calcium-binding protein was significantly higher in the material obtained from the animals fed the low calcium diet than in that from the animals fed the high calcium diet. The binding activity from rechromatographed calcium-binding protein existed as two bands on polyacrylamide electrophoresis. In material from the animals on the low calcium diet, there was little activity in the form of band 1, whereas in the material from the animals on the high-calcium diet, more than half was in the form of band 1. Both bands were vitamin D-dependent. When animals on the high-calcium diet were placed on a low calcium diet, their calcium-binding protein concentration increased by

35% within 24 hr and by 48% within 48 hr, by that time reaching a level typical of animals on a low-calcium diet. Measurement of the diurnal variation in calcium-binding protein and mucosal calcium in animals allowed access to feed only at night, revealed significant inverse oscillations. The results suggest that the calcium-binding capacity (i.e., calcium-binding protein) is an inverse function of the calcium concentration of the mucosal tissue, which, in turn, appears to reflect absorbed calcium in transit.

2453 ANALYSIS OF THE COMPONENTS OF BILE FLOW IN THE RHESUS MONKEY. *(E.)* Strasberg, S. M.; Ilson, R. G.; Siminovitch, K. A.; Brenner, D.; Palaheimo, J. E. (Dep. Surg., Univ. of Toronto, Canada). *Am. J. Physiol.* 228(1):115-121, 1975.

The components of bile flow was studied in three groups of rhesus monkeys. In the first group the clearance of [^{14}C]-erythritol was shown to be a canalicular process by using monkeys that had the bile flow diverted externally and who had been given [^{14}C]-erythritol (0.02 μCi, infused by peristaltic pump), sodium taurocholate (10 mM/day, i.v.), and secretin (20 U/hr, i.v.). Flow, canalicular clearance, bile salt secretion, and bicarbonate secretion were studied in a second group of monkeys after resection of the gastric antrum and small bowel. These animals were given sodium taurocholate (6-10 mM/day i.v.), and erythritol-^{14}C (0.01 μCi/min steady infusion). Canalicular clearance of erythritol was shown to be equal to canalicular flow. Ductular reabsorption was constant at all bile salt secretion rates in the individual animal, and bicarbonate secretion was dependent on bile salt secretion. In group 3 bile flow, bile salt secretion, bicarbonate secretion and canalicular flow were studied over a 2 week period while the animals received intraduodenal sodium taurocholate (3-10 mM/day) and labeled (0.01 μCi/min) and unlabeled erythritol (6-10.0 mM/day) during feeding and fasting. The variability in bile flow in the fasting animal at one bile secretion rate was linearly related to bicarbonate secretion. A multivariate regression model was proposed to describe bile flow in the rhesus monkey based on these study groups. This model enabled the authors to show that the variations in the relationship between bile flow and bile salt secretion rate, in the fasting animal, were due to ductular flow, related to the secretion of bile salt-independent bicarbonate.

2454 ELECTROPHYSIOLOGY OF THE FROG GASTRIC MUCOSA WITH SUFFICIENT CO_2. *(E.)* Kidder, III, G. (Sch. Dent., Univ. Maryland, Baltimore). *Am. J. Physiol.* 228(3):928-933, 1975.

Electrophysiological parameters were compared in bullfrog gastric mucosa perfused with a solution containing 5% CO_2 (standard) and 10% CO_2 (for maximum acid secretion), in the gaseous phase. The mucosa was removed, mounted in a chamber, and perfused with bicarbonate-Ringer solution on the serosal surface and similar but unbuffered solution on the mucosal surface. Acid secretory rate was measured by the pH-stat method, and potential difference by KCl/calomel reference electrodes. Measurements were made during the last 30 min of a 1 hr experimental period. Tissues were exposed either to the 5% or the 10% solution. The secretory rates were 2.17 and 4.44 μEq/cm^2/hr for the 5% and 10% CO_2 solutions, resp. Secretory lag (time between readmission of O_2 after a 20 min anaerobic period, and the rise of the secretory rate to 50% of the maximum) was 6.56 and 8.44 min for the 5% and 10% solutions, resp. Potential differences were 22.2 and 31.5 mV, resp. Secretory overshoot (ratio of peak secretory rate on reoxygenation to the steady-state rate during the following hr) was 125% and 105% of steady state, resp. All differences were statistically significant. Tissues subjected to 1 hr of anoxia during preparation showed an unexpected sudden potential drop (11 to -1 mV in 1 min) when exposed to the 10% solution; a normal potential decrease to 7.3 mV in 1 min occurred with the 5% solution. For 21 tissues, after 1 hr of anoxia the sudden potential drop occurred 35.0 min after anoxia for 14-58 min at 8.2 mV. On reoxygenation, the potential difference rose at 7.0 min and the secretory lag was 21.7 min. It is concluded that removal of CO_2 as a limiting factor by using a 10% concentration has effects on parameters other than acid secretion, including a sudden potential drop completely new to these conditions.

2455 REDUCTION OF CALCIUM ABSORPTION DUE TO DIVERSE INHIBITORS OF ALKALINE PHOSPHOMONOESTERASE. *(Fr.)* Fournier, P.; Dupuis, Y.; Digaud, A.; Fournier, A. (Fac. Pharm. Biol. Sci. Chatenay-Malabry, France). *C. R. Acad. Sci.* [*D*] *(Paris)* 279(6): 497-500, 1974.

After an overnight fast, male Wistar rats were given 2ml of various calcium solutions containing 0.1 μCi of ^{45}Ca/ml p.o. through a stomach tube. Plasma radioactivity was measured after 3 hr, and the animals were sacrificed after 5 or 24 hr. The ^{45}Ca content of a femur, digestive contents and feces (collected from the start of the experiment) was determined. Absorption and retention values for calcium gluconate solutions were up to 5 times higher than for calcium glycerophosphates, while calcium chloride values fell in between. The glycerol portion of the glycerophosphates had no effect on calcium absorption, but the phosphate moiety inhibited absorption in proportion to the amount of phosphate present. It is proposed that alkaline phosphatase acts as a calcium-binding protein whose effect is inhibited in the presence of phosphate ions and enhanced in the presence of sugars.

2456 FUNCTION AND STRUCTURE OF THE MUCOSA OF CONTINENT ILEOSTOMY RESERVOIRS IN DOGS. *(E.)* Philipson, B.; Kock, N. G.; Robinson, J. W. L.; Menge, H.; Mirkovitch, V. (Sahlgrenska Hosp., Univ. Goteborg, Sweden). *Gut* 16(2):132-136, 1975.

Morphological changes and absorptive capacity were studied in continent ileostomy reservoirs in the dog. Nineteen mongrel dogs had the ileum divided about 7 cm from the ileocecal valve, and the distal stump closed. A loop of ileum was constructed into a pouch, fixed in the abdomen, and the outlet passed through the abdominal wall to create an ileostomy. A catheter was inserted before closure for volume

registration and drainage. After 3-4 days the permanent cahteter was removed and the reservoir emptied 3 times daily by insertion of a catheter. After 9-29 days the reservoir was emptied, its volume was determined by saline insufflation, and it was removed with 50 cm of proximal small intestine. Tissue samples were cut parallel to the villus/crypt axis, and fixed and stained. Samples of mucosa were also separated from the muscle and incubated for 1 hr in ^{14}C-labeled L-phenylalanine or β-methyl-D-glucoside, and other samples were incubated with ^{14}COOH-inulin to determine extracellular space. Oxygen consumption and acid phosphatase release were determined after incubation in Krebs phosphate buffer containing 2 mg/ml glucose. Of 19 dogs, 8 survived long enough for characteristic changes to occur in the reservoir. In these the mean volume of the reservoirs had increased by 280 ml. The villi were fingerlike and shorter than normal with occasional mosaic forms. Morphometric evaluations showed also an increase in villous width and a reduction in epithelial cell height. The mitotic index of the reservoir mucosa was 3.05 while that of the proximal intestine was 2.25, a significant difference. There was a significant reduction of phenylalanine and β-methyl glucoside transport in the mucosa of the pouch and the proximal intestine, but no significant difference between these 2 areas. Oxygen consumption and phosphatase release were both lower than control values, but the same for both reservoir and proximal intestine. Results suggest that the reservoir mucosa undergoes a hyperregenerative transformation from the exogenous stress of its contents, and the number of active absorbing cells is reduced.

2457 AN EXPERIMENTAL METHOD OF IDENTIFYING AND QUANTIFYING THE ACTIVE TRANSFER ELECTROGENIC COMPONENT FROM THE DIFFUSIVE COMPONENT DURING SUGAR ABSORPTION MEASURED IN VIVO. *(E.)* Debnam, E. S.; Levin, R. J. (Dep. Physiol., Univ. Sheffield, England). *J. Physiol. (Lond.)* 246(1):181-196, 1975.

The kinetics of active sugar transport in the rat jejunum were measured *in vivo* using the traditional chemical techniques together with a new method utilizing the electrical potential difference generated across the intestine by the coupled movement of ions with the transport of sugars. Prewarmed solutions of bicarbonate saline containing increasing concentrations of glucose, galactose, or α-methyl glucoside were circulated through cannulated jejunal segments of pentobarbitone-anesthetized male rats. After circulating 15 min, the absorption of sugar by the gut was determined. Sugar absorption estimated by chemical methods exhibited two components: one was phlorhizin-sensitive, saturable, and generated electrical potential differences (electrogenic active component); the other was phlorhizin-insensitive, nonsaturable, and did not generate electrical potentials (diffusive component). The diffusive component of the actively transported sugars was identical to the absorption behavior of sorbose, a hexose which is not actively transferred. A method was developed for correcting the data obtained from chemical absorption studies for the diffusive component. The corrected, operational kinetic constants for apparent K_m, obtained by this method were not significantly different from values obtained electrically. The identity between the values obtained by the two methods supports the concept that they represent a measure of the same rate-limiting step in the absorption process. The electrical method for obtaining apparent K_m appears to offer a simple, relatively rapid method of obtaining major operational kinetic parameters of the active intestinal electrogenic absorption process; the technique can also be used with amino acids.

2458 URINARY EXCRETION OF 5-METHYLTETRAHYDROFOLATE AND LIVER S-ADENOSYLMETHIONINE LEVELS OF RATS FED A VITAMIN B_{12}-DEFICIENT DIET. *(E.)* Vidal, A. J.; Stokstad, E. L. R. (Dep. Nutr. Sci., Univ. California, Berkeley). *Biochim. Biophys. Acta* 362(2):245-257, 1974.

The effect of ethionine and methionine on the uptake and urinary excretion of tritiated folic acid was studied, along with the effect of methionine and vitamin B_{12} on the liver concentration of S-adrenoxyl-methionine. Weanling male Sprague-Dawley rats were maintained on a basal diet deficient in vitamin B_{12} and containing only a 0.2% methionine. Supplemental D,L-methionine (15 g/kg) and vitamin B_{12} (100 μg/kg) were included in the diet, and supplemental D,L-ethionine (12.5 mg) was injected i.p. Tritiated folic acid (30 μCi) was injected i.p. and 24 hr later the folate derivatives in the liver were determined by DEAE-cellulose and sephadex chromatography. The uptake of radioactivity by the liver was depressed in the animals fed the basal diet. The uptake returned to control values when methionine, ethionine, and/or B_{12} were given as supplements; the increased uptake occurred primarily in the polyglutamate fractions. The basal diet also caused an increase in the excretion of radioactivity in the urine; in these animals, 5-methyltetrahydrofolate represented 65% of the total urinary radioactivity, while 10-formyltetrahydrofolate plus 5-formyltetrahydrofolate represented 19%. B_{12}, methionine, and/or ethionine supplementation normalized these levels to about 45% and 39%, resp. Rats fed the basal diet showed a significant decrease (to approximately 33 nM/g wet tissue) in hepatic S-adenosylmethionine. Dietary supplementation with methionine and/or B_{12} returned the levels to a normal 60 nM/g. Perfusion of the deficient liver with 300 μM of L-methionine for 1 hr increased the levels to approximately 115 nM/g. The effect of methionine appears to be direct, while that of B_{12} is mediated *via* the *de novo* synthesis of methionine. The results support the "methyl-block" hypothesis, which holds that in a primary cobalamin deficiency, folate may be trapped as N-5-methyltetrahydrofolic acid due to a partial block in the methylation of homocysteine and an essentially irreversible N-5-methyltetrahydrofolic acid reductase reaction.

2459 THE DIFFERENCE IN THE CLEARANCE OF INTERSTITIAL ALBUMIN BY THE LYMPHATICS FROM THE STOMACH AND THE SMALL AND LARGE INTESTINE. *(E.)* Sheppard, M. S.; Sterns, E. E. (Dep. Surg., Queen's

Univ., Kingston, Canada). *Surg. Gynecol. Obstet.* 140(3):405-408, 1975.

The ability of the lymphatics to clear interstitial protein from the stomach, mid-portion of the small intestine, and colon was studied. Radioiodinated serum albumin (0.05 ml) was injected into the stomach, small intestine, and colon of pentobarbital-anesthetized dogs. Thoracic duct lymph was collected over the following 5 hr, and portal and vena caval blood samples were drawn intermittently during the same period; saline, equal in volume to the blood and lymph removed, was infused i.v. During the 5-hr experimental period, about 9% of the interstitially injected albumin was returned by the thoracic duct lymph; 98 min were required for 0.1% of the injected dose to appear in the lymph. Immediately after albumin injection, 1.1% of the injected dose appeared in the blood; this increased to 2.3% after 5 hr. Residual activity at the site of injection was 44%. Similar results were obtained after the injection of albumin into the colon. Significantly more of the injected activity was recovered from the thoracic duct lymph after injection into the small intestine (37%) than after injection into the stomach or colon. The time required for 0.1% of the dose to appear in the lymph (13 min) was also significantly lower after injection into the small intestine. The initial and final blood values (3.6% and 6.3%) were higher after small intestinal injection, and significantly less radioactivity remained at the site of injection (8.6%). The results suggest that the small intestine clears interstitial albumin more rapidly and effectively than the large intestine and stomach and that the colonic and gastric lymphatics behave similarly to each other and significantly differently from those of the small intestine with regard to the transport of interstitial albumin.

2460 STUDIES ON A WIDE-SPECTRUM INTESTINAL DIPEPTIDE UPTAKE SYSTEM IN THE MONKEY AND IN THE HUMAN. *(E.)* Das, M.; Radhakrishnan, A. N. (Christian Med. Coll. Hosp., Vellore, India). *(Biochem. J.* 146(1):133-139, 1975.

The intestinal transport of glycine and leucine residues of glycyl-L-leucine was studied in the monkey and in the human *in vitro*. The region of the monkey intestine at 35-40% distance of the total length of intestine from the pyloric end was used in all experiments. The human intestinal specimen (7.6 cm long) was resected from the jejunal region of a patient undergoing corrective surgery for complications arising after a gastroenterostomy. Each intestinal strip (10-20 mg) was preincubated at the same temperature as the incubation step in 2 ml of oxygenated Krebs-Ringer bicarbonate buffer, containing 0.5% glucose. The medium was then aspirated, fresh medium containing the peptide solution was added, and the mixture incubated for 2 min at 37 C. Radioactivity was measured in a liquid-scintillation counter. Uptake of both [^{14}C]glycyl-L-leucine and glycyl-L-[^{14}C]-leucine showed similar K_t values, but there was a marked difference in the maximal uptake rate (V_{max}) values. This difference in the V_{max} values may be due to the greater efflux rate of glycine from the tissue. Arrhenius plots of both [^{14}C]glycyl-L-leucine uptake and glycyl-L-[^{14}C]leucine uptake in the monkey intestine showed a discontinuity at about 20 C. The activation energies above and below the discontinuity are similar for both [^{14}C]glycyl-L-leucine uptake and glycyl-L-[^{14}C]leucine uptake. These similarities suggest that the dipeptide glycyl-L-leucine is transported as one unit. In the monkey intestine, glycyl-L-leucine uptake was inhibited by a wide variety of dipeptides, including those containing acidic and basic amino acids. The inhibition was shown to be competitive by using 4 representative dipeptides: L-alanyl-L-alanine, L-alanyl-L-leucine, L-glutamyl-L-glutamic acid and L-lysyl-L-lysine. The results suggest that in the monkey intestine there may be a dipeptide uptake system with an extremely broad specificity. The specificity of glycyl-L-[^{14}C]leucine uptake in the human intestine was studied in a very limited way. All 5 dipeptides tested were inhibitory. L-Alanyl-L-leucine and L-lysyl-L-phenylalanine were strong inhibitors, whereas L-glutamyl-L-glutamic acid, glycyl-L-proline and L-prolyl-glycine were less potent inhibitors. The results suggest that the specificity of dipeptide uptake in the human may be very similar to that in the monkey.

2461 SMALL INTESTINAL MALABSORPTION OF VITAMIN B_{12} IN IRON-DEFICIENT RATS. *(E.)* Yeomans, N. D.; St. John, D. J. B. (Monash Univ. Dep. Med., Melbourne, Australia). *Pathology* 7(1):35-44, 1975.

The mechanism of vitamin B_{12} malabsorption in iron deficiency was studied in female Sprague-Dawley rats. Weanling rats were maintained on an iron-deficient diet and bled at weekly intervals to speed the development of iron deficiency. Control rats were fed the iron-deficient diet supplemented with ferrous iron and some of the iron-deficient rats were repleted with parenteral iron before measurement of B_{12} absorption. B_{12} absorption was determined by isolating small intestinal loops *in vivo* and measuring the absorption of ^{57}co-vitamin B_{12} bound to a known quantity of intrinsic factor in the gastric juice. The mean corpuscular hemoglobin concentration was significantly reduced in the iron-deficient rats and no stainable iron was present in their livers. In these animals, the intestinal uptake and transport of B_{12} were significantly below control values; intestinal uptake and transport were to some extent interdependent. In the iron-deficient rats repleted with iron, the uptake and transport of B_{12} were normal within 3 days; at this time, the mean hemoglobin concentration had increased significantly and iron had reappeared in the hepatocytes and was present in Kupffer cells in supra-normal amounts. There was no correlation between hemoglobin level and B_{12} absorption, although there was a significant inverse relationship between hemoglobin level and ^{57}Co-B_{12} incorporation into the liver. Basal intrinsic factor secretion did not differ in the iron-deficient and control rats, and there was no significant difference in bacterial counts in the intestinal washings or small intestinal histology. Cecal enlargement, due primarily to increased cecal contents,

was noted in all iron-deficient and none of the iron-supplemented rats. The results indicate that malabsorption of B_{12} in iron deficiency occurs as a result of an abnormality in the intestinal phase of absorption and is unrelated to any possible effect of iron deficiency on the stomach.

2462 METABOLISM OF IRON BY RATS FED WHEAT DIETS SUPPLEMENTED WITH LYSINE AND METHIONINE. *(E.)* Miller, J. (Univ. Georgia Coll. Agric. Exp. Stn., Georgia Stn., Experiment). *Nutr. Rep. Int.* 10(1):1-8, 1974.

The effect of the protein quality of bread on the absorption of iron from the bread was studied. Weanling Sprague-Dawley rats were maintained for 6 weeks on gluten (20%) or raw white wheat flour (88.8% enriched white wheat flour) diets supplemented with 0, 0.25, or 0.5% l-lysine HCl or 0.45% lysine plus 0.2% l-methionine. After 6 weeks, the animals were exsanquinated and their hematological status assessed. The animals fed the 20% gluten diet grew slowly; supplementation of the diet with lysine brought about a marked improvement in growth rate and feed efficiency which were directly related to the amount of lysine added. The rats fed the unsupplemented flour diet also gained weight slowly, but grew at a greater rate than those fed the unsupplemented gluten diet. The addition of lysine to the flour diet more than doubled the growth rate with no increase in food intake; the further addition of methionine resulted in reduced food intake with no change in growth rate. However, even with the addition of both lysine and methionine, the growth rate was only about 1/2 that expected of animals fed balanced diets. The addition of lysine to either diet increased the total iron content in the spleen and carcass, but had little effect on the iron content of the liver. The concentration of iron in the livers of the flour-fed rats was unusually high compared with rats fed a balanced diet. Amino acid supplementation of both diets increased the blood hematocrit and the blood hemoglobin concentration. In the flour-fed animals, lysine also increased the average volume/cell and the quantity of hemoglobin/cell, but lowered the serum iron content. In the gluten-fed rats, lysine increased the serum binding capacity. Osmotic fragility of the RBC was not affected by diet. The results indicated that the low protein quality of the 2 diets resulted in a relatively greater diminution in the synthesis of hemoglobin compared with other proteins associated with growth; as a result, an excessive amount of the absorbed iron was transferred to storage compartments such as the liver and bone marrow.

2463 IN VIVO D-GLUCOSE ABSORPTION IN THE DEVELOPING RAT SMALL INTESTINE. *(E.)* Younoszai, M. K.; Lynch, A. (Coll. Med., Univ. Iowa, Iowa City). *Pediatr Res* 9(3):130-133, 1975.

The rates of D-glucose absorption in the small intestine of rats of various ages were measured *in vivo* using a one-pass perfusion technique. Solutions of D-glucose (1-20 mg/ml) were perfused *in situ* through the jejunum and ileum of anesthetized Holtzman rats aged 7-8, 14-15 (suckling), 21-23 (weanling), 35-36, or 70-73 days. The amounts of glucose absorbed expressed as percentage of load perfused (normalized for intestinal weight, mg/hr/g wet weight) were greater in the weanling than in suckling pups. The rate of glucose absorption increased with increasing glucose concentration in the perfusion solutions and reached a plateau when the concentration exceeded 3 mg/ml in the suckling and 10 mg/ml in the weanling rats. Based on intestinal weight, absorption rates (mg/hr/gm wet weight) from solutions containing 10 mg/ml glucose were 2-fold higher in the 21- to 23-day-old rats than in the 7- to 8-day-old pups. Glucose absorption rates (mg/hr/g wet weight of the perfused intestine) from the 20 mg/ml solution were similar in rats aged 21-23 (64), 35-36 (60), and 70-73 (58) days; however, when based on length of intestinal segments, absorption rates were significantly greater in the older rats. The data suggest that in rats the ability of the small intestine to absorb glucose/unit weight about doubles at the time of weaning as compared with the suckling period, with no further enhancement thereafter. They further suggest that the same stimulus which increases small intestinal sucrase activity also brings about changes in the glucose transporting mechanism.

2464 EFFECT OF ASPIRIN, ANTACID, AND ALCOHOL ON THE POTENTIAL DIFFERENCE IN THE HUMAN STOMACH. *(Ger.)* Caspary, W. F. (Med. Clin., Univ. Gottingen, Germany). *Z. Gastroenterol.* 12(Suppl.): 419, 1974.

2465 THE EFFECT OF TEA ON IRON ABSORPTION. *(E.)* Disler, P. B.; Lynch, S. R.; Charlton, R. W.; Torrance, J. D.; Bothwell, T. H.; Walker, R. B.; Mayet, F. (Iron Red Cell Metab. Unit, South African Med. Res. Counc., Johannesburg). *Gut* 16(3):193-200, 1975.

2466 INHIBITION OF INTESTINAL BILE ACID ABSORPTION BY BIGUANIDES. *(Ger.)* Caspary, W. F.; Lucke, H.; Creutzfeldt, W. (Med. Clin., Univ. Gottingen, Germany). *Z. Gastroenterol.* 12(Suppl.): 423, 1974.

2467 THE EFFECT OF PRENYLAMINE (SEGONTIN) ON SMALL INTESTINE ABSORPTION IN MAN. *(Ger.)* Gottesburen, H.; Raida, H.; Riecken, E. O. (Med. Clin., Univ. Marburg/Lahn, Germany). *Z. Gastroenterol.* 12(Suppl.):426, 1974.

2468 ABSORPTION OF MORPHINE, BUTYLSCOPOLAMINE, MECAMYLAMINE AND PHENOBARBITONE FROM THE SMALL INTESTINE OF THE TRIPARANOL-TREATED RAT IN SITU. *(E.)* Venho, V. M. K. (Dep. Pharmacol., Univ. Helsinki, Finland). *Arzneim. Forsch.* 25(2): 232-234, 1975.

2469 THE EFFECT OF PENTAGASTRIN AND GLUCAGON ON WATER, ELECTROLYTE, AND GLUCOSE ABSORPTION IN THE HUMAN JEJUNUM. *(Ger.)* Ewe, K.; Laubenthal, G.; Hoditz, U. (1st Med. Clin. Polyclin., Univ. Mainz, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:845-847, 1973.

2470 INTESTINAL TRANSPORT OF GLUCOSE, AMINO ACIDS AND ELECTROLYTES IN LEAD POISONING. *(E.)* Wapnir, R. A.; Exeni, R. A.; McVicar, M.; Lifshitz, F. (North Shore Univ. Hosp., Manhasset, N.Y.). *Fed. Proc.* 34(3):917, 1975.

2471 ENTERIC MICROFLORA EFFECTS ON INTESTINAL TRANSPORT OF CARBOHYDRATES. *(E.)* Lifshitz, F.; Wapnir, R. A.; Wehman, H. J.; Hawkins, R. L.; Diaz-Bensussen, S. (North Shore Univ. Hosp., Manhasset, N.Y.). *Fed. Proc.* 33(3):673, 1974.

2472 EFFECT OF SINGLE AND COMBINED INFUSIONS OF ANGIOTENSIN II AND ALDOSTERONE ON COLONIC POTENTIAL DIFFERENCE, BLOOD PRESSURE AND RENAL FUNCTION, IN PATIENTS WITH ADRENAL DEFICIENCY. *(E.)* Efstratopoulos, A. D.; Peart, W. S. (St. Mary's Hosp. Med. Sch., London, England). *Clin. Sci. Mol. Med.* 48(3):219-226, 1975.

2473 KINETICS OF GLYCEROL UPTAKE BY THE PERFUSED RAT LIVER. MEMBRANE TRANSPORT, PHOSPHORYLATION AND EFFECT ON NAD REDOX LEVEL. *(E.)* Sestoft, L.; Fleron, P. (Dep. Biochem. A, Univ. Copenhagen, Denmark). *Biochim. Biophys. Acta* 375 (3):462-471, 1975.

2474 INTESTINAL ABSORPTION AND ELECTROLYTE ABSORPTION. *(E.)* Gurll, N. J.; Zinner, M. J. (Div. Surg., Walter Reed Army Inst. Res., Washington, D.C.). *Am. Surg.* 41(4):189-192, 1975.

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2500 EXCRETION OF CREATININE INTO GASTROINTESTINAL TRACT IN RENAL-ARTERY-LIGATED RATS. *(E.)* Terato, K.; Yamakawa, S.; Yoshino, Y. (Eisai Res. Lab., Tokyo, Japan). *Chem. Pharm. Bull. (Tokyo)* 23(1):237-239, 1975.

See also, 2598, 2790, 2817, 3223, 3294, 3678.

MOTILITY

2501 INHIBITORY ACTIONS OF LAXATIVES ON MOTILITY AND WATER AND ELECTROLYTE TRANSPORT IN THE GASTROINTESTINAL TRACT. *(E.)* Stewart, J. J.; Gaginella, T. S.; Olsen, W. A.; Bass, P. (Cent. Health Sci., Univ. Wisconsin, Madison). *J. Pharmacol. Exp. Ther.* 192(2):458-467, 1975.

The effects of an irritant (castor oil) and an osmotic (magnesium sulfate) diuretic on gastrointestinal motility and water and electrolyte transport were compared in 6 healthy dogs. Circular smooth muscle activity was monitored by extraluminal strain gauge transducers at different sites along the gastro-

intestinal tract following gastric intubation of 45 ml of water and castor oil or a 30% solution of magnesium sulfate, after feeding or 20 hr fasting. Decreases in total activity were found for both cathartics in the antrum and ileum. Further analysis revealed that decreases in the ileum occurred primarily due to a decrease in contractile rate, whereas antral decreases could be attributed primarily to a decrease in force/contraction. Proximal colonic activity tended to decrease after laxatives and feeding. The effects of ricinoleic acid, isotonic and hypertonic solutions of magnesium sulfate and mannitol on net water and electrolyte absorption were tested on everted segments of hamster jejunum. Sodium ricinoleate (2.0 mM) reduced net water transport by 48%. Magnesium sulfate, like mannitol, only reduced net water absorption when present as a component of a hypertonic mucosal solution. The results suggest that both inhibition of water absorption and reduced circular smooth muscle activity may be important factors in castor oil- and magnesium sulfate-induced catharsis.

2502 THE VOLUME AND ENERGY CONTENT OF MEALS AS DETERMINANTS OF GASTRIC EMPTYING. *(E.)* Hunt, J. N.; Stubbs, D. F. (Guy's Hosp. Med. Sch., London, England). *J. Physiol. (Lond.)* 245(1):209-225, 1975.

Information from 33 published and unpublished studies of gastric emptying was used to determine quantitative relations between nutritive density of meals and emptying behavior of the stomach. Calculations were based upon gastric emptying of food during the first 60 min of the emptying process, volumes of meals 50-1250 ml, and varied composition with nutritive densities of 0-2.3 kcal/ml. The greater the density of the meal, the lesser was the volume transferred to the duodenum (independent of initial volume), but the rate of delivery of energy to the duodenum (nutritive density times volume delivered) was not affected. Based upon the interaction of stimulus (kcal/ml) and duodenal receptors it was possible to predict the rate of gastric emptying, given the nutritive density of the meal. Dietary carbohydrates and triglycerides added to test meals slowed gastric emptying (higher concentration, slower emptying) due to intraduodenal concentration of digestion products (monosaccharides or salts of fatty acids). It is concluded that isocaloric amounts of fat, protein and carbohydrate (e.g. 4 g fat, 9 g carbohydrate) result in equal slowing of gastric emptying.

2503 RATE OF GASTRIC EMPTYING OF PHENOL RED IN A RABBIT. *(E.)* Goto, S.; Yamagata, T.; Tsuzuki, O.; Iguchi, S. (Fac. Pharm. Sci., Okayama Univ., Japan). *Chem. Pharm. Bull. (Tokyo)* 21(11): 2495-2499, 1974.

The gastric emptying of phenol red both alone and with the simultaneous administration of aminopyrine and caffeine was studied quantitatively in male rabbits. After a series of 5 washings of the rabbit stomach with warm water *via* a vinyl tube, 100 ml isotonic solution containing phenol red alone or phenol red and one of the drugs was instilled into the stomach during 1 min. The vinyl tube was removed and reinserted after a specified time for removal of the gastric content by gentle aspiration with a syringe. Twelve rabbits were used in the experiment with phenol red alone; the tests were performed at weekly intervals with the same rabbit. For the first 2 months the gastric emptying behavior was almost always reproducible, but there was some variation after 3 months. The gastric emptying pattern, 75 min after p.o. administration, showed the percent of residual phenol red in the rabbits at the initiation of the experiment to range from 16.5 to 25.5%, whereas after 3 months the range of values was 4.1 to 7.0%. Corresponding ranges for the residual total volume were 33 to 41 ml and 13 to 16 ml, resp. Gastric emptying and the volume of gastric content were governed by first-order kinetics in the case of phenol red alone. The simultaneous administration of aminopyrine (900 mg) caused a smaller exponential decline in the amount of phenol red than was found when phenol red was administered alone. Caffeine (50, 200, and 300 mg) produced no such effect. These results support the previously reported hypothesis that aminopyrine suppresses the transfer of phenol red to the duodenum and that simultaneously administered drugs such as caffeine, which have no effect on the gastric emptying of phenol red, can eliminate the effect of aminopyrine and reduce its gastric emptying time.

2504 INTESTINAL SMOOTH MUSCLE ELECTRICAL POTENTIALS RECORDED FROM SURFACE ELECTRODES. *(E.)* Brown, B. H.; Smallwood, R. H.; Duthie, H. L.; Stoddard, C. J. (Weston Park Hosp., Sheffield, England). *Med. Biol. Eng.* 13(3):97-103, 1975.

The source of electrical signals recorded from the human small intestine using surface electrodes was studied. Electrodes were placed on the trunks of 16 normal subjects, 3 pairs over the gastroduodenal area and a 4th pair placed across the chest and used to record respiration. Recordings were made after fasting and immediately following a meal. Fourier analysis and correlation methods were used to analyze the data. A significant frequency component at approximately 3 cycles/min (average 3.02 min) was found in 88% of the stretches of record analyzed. It is unlikely that the signals were an electrode artifact or that they were the result of mechanical artifacts from the gut. Evidence indicates that the signal arose from the basic electrical rhythm of the stomach. In 28% of the recordings, consistent activity was found at a frequency of 10-12 cycles/min (average 10.8 cycles/min); this activity was found almost exclusively in the records made in the fasting state. Although this activity is near respiratory frequencies, simultaneous monitoring of respiration enabled the waveforms to be separated. The source of these rhythms is probably either the small or large bowel.

2505 INFLUENCE OF THE HORMONE ANALOGUE 13-NLE-MOTILIN AND OF 1-METHYL-3-ISOBUTYLXANTHINE

ON TONE AND CYCLIC 3'5'-AMP CONTENT OF ANTRAL AND DUODENAL MUSCLES IN THE RABBIT. *(E.)* Schubert, E.; Mitznegg, P.; Strunz, U.; Domschke, W.; Domschke, S.; Wunsch, E.; Jaeger, E.; Demling, L.; Heim, F. (Dep. Pharmacol., Univ. Erlangen-Nuremberg, Erlangen, Germany). *Life Sci.* 16(2):263-272, 1975.

To investigate whether changes in the cyclic AMP content lead to changes in smooth muscle tone and whether tone enhancement by acetylcholine and 13-norleucine-motilin is antagonized by an increase in endogenous cyclic AMP, the influence of 1-methyl-3-isobutylxanthine (isobutyltheophylline), norleucine-motilin, and acetylcholine on muscle tone and the content of cyclic AMP was studied. The cyclic AMP content of mucosa-free preparations of rabbit antral and duodenal muscles was increased 72% and 126%, resp., by isobutyltheophylline (2-3 x 10^{-4} M). 13-Norleucine-motilin (1.8 x 10^{-7} M), an analogue of the duodenal tissue hormone motilin, and acetylcholine (1.8 x 10^{-6} M) had no effect on the cyclic AMP content of the antral and duodenal muscles when given alone or in combination with isobutyltheophylline. In contrast, norleucine-motilin (1.8 x 10^{-7}) increased and isobutyltheophylline (3 x 10^{-4} M) decreased smooth muscle tone in the duodenum. The tone-enhancing effect of norleucine-motilin was reversed by the subsequent administration of isobutyltheophylline, whereas the muscle tone lowered by isobutyltheophylline was returned to its initial state by norleucine-motilin. The basic tone of the antral muscle was not reduced by isobutyltheophylline. However, pretreatment with isobutyltheophylline (2 x 10^{-4} M) significantly reduced (60%) the contraction-promoting effect of norleucine-motilin. It is assumed that changes in the tone or response of antral and duodenal muscles to norleucine-motilin administered after isobutyltheophylline are due to the increased tissue content of cyclic AMP. The antagonistic effects of cyclic AMP and motilin on the gastrointestinal muscles might be of physiological importance for the regulation of gastrointestinal motor activity.

2506 MANOMETRIC EVALUATION OF THE PAPILLA OF VATER. *(E.)* Nebel, O. T. (Nav. Reg. Med. Cent., San Diego, Calif.). *Gastrointest. Endosc.* 21 (3):126-128, 1975.

A new technique for manometry of the sphincter of Oddi is described. Preliminary studies were performed in five volunteers, and subsequent studies in 20 patients being evaluated for abdominal pain who were found to have no organic disease. The manometric catheter was 1.5 mm in diameter, 200 cm long, and the end of the tube was sealed, with a side hole 0.8 mm in diameter just behind the sealed portion. The proximal end had a standard i.v. fitting. During the measurements, the catheter was perfused with distilled water at 0.2 ml/min. Intraluminal pressure was transmitted through the catheter to an external transducer and recorded. Pressure for each min of measurement was calculated using duodenal pressure as zero reference. The catheter was inserted beyond the sphincter into the pancreatic duct or biliary tree, and slowly pulled through into the duodenum under direct endoscopic vision. Tests on the 5 volunteers demonstrated that the sedative diazepam (15 mg i.v.) caused no significant change in sphincter pressure, and this dose was used to sedate the 20 patients. Sphincter pressure in the 20 patients ranged from 18-45 mm Hg. The procedure was well tolerated by the patients and added only 15 min to normal duodenoscopy time. It is concluded that there is a high pressure area in the region of the papilla of Vater that can be measured by endoscopic manometric techniques.

2507 RESPONSE OF THE HUMAN CARDIAC SPHINCTER TO CIRCULATING PROSTAGLANDINS $F_{2\alpha}$ AND E_2 AND TO ANTI-INFLAMMATORY DRUGS. *(E.)* Dilawari, J. B.; Newman, A.; Poleo, J.; Misiewicz, J. J. (Cent. Middlesex Hosp., London, England). *Gut* 16(2):137-143, 1975.

The effects of i.v. prostaglandins $F_{2\alpha}$ and E_2 on motor responses of the gastroesophageal junction, and the effect of rectal indomethacin on cardiac sphincter pressure, were studied in 41 subjects. Three of the 41 were normal while 37 had upper abdominal complaints related to peptic ulceration or gastroesophageal reflux. Bolus injection of prostaglandin $F_{2\alpha}$ (2.5-40 µg/kg) had no effect on cardiac sphincter pressure, but i.v. infusion (0.05-0.8 µg/kg/min) for 20 min resulted in a marked increase of sphincter pressure from 10 min after the start to 15-20 min after the finish of infusion. Sphincteric relaxation during swallowing was prolonged, and this effect was significant in 4 subjects given 0.8 µg/kg/min. Neither esophageal peristalsis nor gastric fundic motility was significantly affected by prostaglandin $F_{2\alpha}$; plasma gastrin levels were unaltered. Although prostaglandin E_2 (0.1-0.08 µg/kg/min) had no effect on any variable of intraluminal pressure, i.v. infusion of 0.08 µg/kg/min inhibited sphincter contractions to serial bolus i.v. injections of pentagastrin (0.1 or 0.2 µg/kg) in 2 of 3 subjects. Rectal indomethacin (200 mg) resulted in a slow rise of cardiac sphincter pressure, suggesting that endogenous synthesis of an inhibitory (E-type) prostaglandin was suppressed. These results indicate that prostaglandin E_2 may be concerned in the regulation of cardiac sphincter tone in man, and that prostaglandin $F_{2\alpha}$ may be useful in the treatment of gastroesophageal reflux.

2508 DIETARY ORIGIN OF CIRCADIAN VARIATIONS IN THE ELECTRICAL ACTIVITY OF THE SMALL INTESTINE IN THE RAT. *(Fr.)* Ruckebusch, M.; Ferre, J. P. (Natl. Vet. Sch., Toulouse, France). *C. R. Soc. Biol.* (Paris) 167(12):2005-2009, 1974.

Jejunal electromyograms of Wistar rats show slow waves (frequency 30-36/min); 45% of these are followed by salvos of 3 to 20 potentials having amplitudes of 50-200 µV in rats fed *ad libitum*. The salvos may either occur very irregularly or in a segmentary manner after every slow wave for 2-3 min.

This type of activity is propagated at a rate of about 2 cm/min along the small intestine. Electrodes were placed at 4 cm intervals along the small intestine of Wistar rats, and the jejunal electromyogram was recorded. There were four groups of 10 rats each: 1) controls fed *ad libitum*; 2) those subjected to fasting with precautions taken to prevent coprophagy; 3) those subjected to fasting with no precautions taken to prevent coprophagy; and 4) those subjected to fasting and equipped with a gastric fistula. In group 1, about 60% of the slow waves were followed by irregular salvos during feeding. When rats stopped eating, about 30% of the slow waves were followed by segmentary salvos. In group 2, salvos followed about 30% of the slow waves and were segmentary after 5 to 6 hr of fasting. Irregular salvos persisted during part of the first 24 hr in group 3. In group 4, when the fistula was used to keep the stomach empty, the pattern of intestinal motility did not change significantly in fasting animals; there were two to three phases of segmentary salvos/hr. When the stomachs of these rats were filled through the fistula, segmentary activity disappeared and was replaced by irregular activity over a period of 3 - 6 hr. Thus, the presence of segmentary salvos in the rat depends upon whether the stomach is empty or full.

2509 INVESTIGATION OF SMALL BOWEL TRANSIT TIME IN MAN UTILIZING PULMONARY HYDROGEN (H_2) MEASUREMENTS. *(E.)* Bond, J. H. Jr.; Levitt, M. D.; Prentiss, R. (VA Hosp., Minneapolis, Minn.). *J. Lab. Clin. Med.* 85(4):546-555, 1975.

A new method of determining small bowel transit time, using lactulose as a test substance and pulmonary hydrogen as an indicator, was investigated. Studies were performed in 42 healthy subjects after a 12-hr fast. Isotonic lactulose solution was ingested (5, 10, or 20 g in 50, 100, or 200 ml water, resp.), and pulmonary hydrogen excretion was measured by having the subjects breathe into a closed system from which periodic aliquots were removed at 8-min intervals and analyzed by gas chromatography. Simultaneously, polyethylene glycol transit time to the terminal ileum was measured in 7 of the normal subjects plus two patients who had had partial gastric resections with Billroth II anastomoses. These subjects were intubated with a mercury-weighted 1.6-mm diameter tube with the tip in the distal ileum. Tube length varied from 275-330 cm. Lactulose (10-20 g) and polyethylene glycol (2-3 g) were ingested, hydrogen excretion was monitered, and serial samples of terminal ileal contents were aspirated every 10 min and analyzed for polyethylene glycol content. Transit time measured by the excretion hydrogen correlated closely with the simultaneously determined time for polyethylene glycol to reach the distal ileum, but lagged behind it for an average of 7.6 min. Transit time following ingestion of 10 g lactulose in 40 subjects averaged 72 min. Repeat measurements performed in 6 subjects showed good reproducibility, differing from the original measurement by ± 14%. In 9 subjects, ingestion of 5, 10, and 20g lactulose resulted in transit times of 128, 94, and 40 min, resp. It is concluded that this technique is a valid and safe means of determining intestinal transit time in man.

2510 RELATIONSHIP BETWEEN SERUM GASTRIN CONCENTRATION AND LOWER-ESOPHAGEAL SPHINCTER PRESSURE. *(E.)* Dodds, W. J.; Hogan, W. J.; Miller, W. N.; Barreras, R. F.; Arndorfer, R. C.; Stef, J. J. (Med. Coll. Wisconsin, Milwaukee). *Am. J. Dig. Dis.* 20(3): 201-207, 1975.

The relation between lower esophageal sphincter pressure and serum gastrin was studied in 16 healthy volunteers (aged 18-30 yr). Subjects fasted overnight and esophageal manometry was performed with a 5-lumen manometric assembly. Side hole recording devices were cut out at the same axial level in 4 cases so that they were radially oriented at 90 degree angles and used to record sphincter resting pressure. A 5th recording orifice was 5 cm proximal to the others. During pressure recording, each catheter was infused with water at 1.6 ml/min. The catheter assembly was passed into the stomach and the pressure recorded by both the conventional station pull-through method, requiring several min, and a rapid pull-through method with continuous withdrawal at 0.5-1.0 cm/sec., three or more of each performed in alternating sequence. Pressure from the standard method recordings was determined by subtracting mean gastric pressure from the highest mean pressure at any station, while maximal pressure from the rapid method recordings was determined by subtracting the steady state gastric pressure during breathholding from the sphincter pressure profile peak. Immediately following the pull-throughs, a venous blood sample was drawn and serum gastrin was determined. No direct correlation was found between gastrin level and lower esophageal sphincter pressure measured by either technique. A significant inverse correlation was found in 10 of the subjects who then participated in a second study 2-8 weeks later, but in the second study the inverse correlation was not significant. Four subjects were studied a 3rd time several weeks after the 2nd study, but no direct correlations were found. It is concluded that there is no simple direct relation in man between resting lower-esophageal sphincter pressure and circulating gastrin levels.

2511 DIFFERENTIATION BETWEEN THE BIOLOGICAL ACTIVITY OF ELEDOISIN AND SUBSTANCE P ANALOGS WITH REGARD TO THEIR AFFINITY TO AND ACTIVITY ON GUINEA PIG ILEUM AND COMPARISON WITH THEIR ACTIVITY ON RAT COLON. *(Ger.)* Bergmann, J.; Oehme, P.; Beinert, M.; Niedrich, H. (Cent. Inst. Mol. Biol., Berlin-Friedrichsfelde, Germany). *Experentia* 30(11):1315-1317, 1974.

2512 THE ROLE OF INHIBITORY NERVES IN COLONIC MOTILITY. *(Ger.)* Wienbeck, M. (Med. Clin., Univ. Marburg, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:850-851, 1973.

2513 MYOELECTRIC CONTROL OF THE COLON. *(E.)* Christensen, J. (Dep. Intern. Med., Univ. Iowa, Iowa City). *Gastroenterology* 68(3):601-609, 1975.

2514 EFFECTS OF ELEVATED MAGNESIUM ON ELECTRICAL DISCHARGE OF NEURONS OF AUERBACH'S PLEXUS. *(E.)* Wood, J. D. (Univ. Kansas Med. Cent., Kansas City). *Fed. Proc.* 34(3):422, 1975.

2515 COMPARATIVE INVESTIGATIONS ON THE EFFECT OF PANCREATIC GLUCAGON AND SECRETIN ON THE MOTILITY OF THE HUMAN PROXIMAL AND DISTAL GASTRO-INTESTINAL TRACT. *(Ger.)* Paul, F. (Med. Coll., Hannover, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79: 841-843, 1973.

2516 GASTRIC EMPTYING OF CARBOHYDRATE VS. FAT IN THE RAT. *(E.)* Trout, D. L.; Conway, E. S. (U.S. Dep. Agric., Nutr. Inst., Beltsville, Md.). *Fed. Proc.* 34(3):910, 1975.

See also, 2528.

SECRETION AND METABOLISM

2517 THE ROLE OF CALCIUM AND CYCLIC NUCLEOTIDES IN α-AMYLASE RELEASE FROM SLICES OF RAT PAROTID: STUDIES WITH THE DIVALENT CATION IONOPHORE A-23187. *(E.)* Butcher, F. R. (Div. Biol. Med. Sci., Brown Univ., Providence, R.I.). *Metabolism* 24(3): 409-418, 1975.

The role of calcium and cyclic nucleotides in the *in vitro* release of α-amylase from tissue slices of rat parotid was studied using the ionophore A-23187, which transports Ca^{++} and other divalent cations across biologic membranes in the direction of the respective cation concentration gradient. Parotid glands from 7-9-week-old female Sprague-Dawley rats were sliced and incubated in media containing A-23187 dissolved in dimethylsulfoxide. α-Amylase release and tissue cyclic nucleotide levels were measured in the presence and absence of theophylline and various blocking agents. A-23187 caused a release of α-amylase from the parotid slices. This release was not affected by the addition of l-propranolol, phentolamine, or atropine to the incubation medium, although all of these agents blocked the effects of isoproterenol, phenylephrine, and carbamylcholine on parotid slices. The ionophore also inhibited the stimulatory effect of isoproterenol on the cyclic AMP levels in the tissue slices, but only if the slices were incubated with A-23187 for 10 min before the isoproterenol was added. A-23187 increased cyclic GMP levels in the slices after 10 min incubation; in the presence of theophylline, this elevation occurred after 5 min incubation. Both the stimulatory effect on α-amylase release and the increase in cyclic GMP by A-23187 were dependent on the presence of Ca^{++} in the incubation buffer. Although these results do not define the mechanism of Ca^{++} action in stimulus-secretion coupling, they do emphasize the importance of Ca^{++} in the regulation of cyclic nucleotide levels.

2518 DISSOCIATION OF RAT PAROTID GLAND. *(E.)* Barka, T.; Van Der Noen, H. (Mt. Sinai Sch. Med., City Univ. New York, N.Y.). *Lab. Invest.* 32(3):373-381, 1975.

2519 SHORT TERM CULTURE OF DISSOCIATED RAT SUBMANDIBULAR GLAND CELLS. *(E.)* Kanamura, S.; Barka, T. (Mt. Sinai Sch. Med., City Univ. New York, N.Y.). *Lab. Invest.* 32(3):366-372, 1975.

2520 CONTRIBUTION OF ORORHINOPHARYNGEAL AND GASTROENTERIC RECEPTORS IN REGULATION OF FOOD AND WATER INTAKE. *(Pol.)* Cytawa, J.; Luszawska, D.; Trojniar, W. (Z. Zakladu Physiol. Inst. Biol. Med., Gdansk, Poland). *Przegl. Lek.* 31(2):272-276, 1974.

2521 LOCALIZATION OF 1,25-DIHYDROXY-VITAMIN D_3 IN CHICK PARATHYROID GLANDS. *(E.)* Henry, H. L. (Dep. Biochem., Univ. California, Riverside). *Fed. Proc.* 34(3):894, 1975.

2522 EFFECT OF FEEDING DIFFERENT LEVELS OF CORN OIL ON THE COMPOSITION OF SUBMANDIBULAR SALIVARY GLAND FATTY ACIDS IN RATS. *(E.)* Alam, S. Q. (Sch. Dent., Lousiana State Univ., New Orleans). *Arch. Oral Biol.* 20(2):97-102, 1975.

2523 POSTNATAL DEVELOPMENT OF ADENYLATE CYCLASE IN RAT SALIVARY GLANDS: PATTERNS OF HORMONAL SENSITIVITY. *(E.)* Grand, R. J.; Chong, D. A.; Ryan, S. J. (Harvard Med. Sch., Boston, Mass.). *Am. J. Physiol.* 228(2):608-612, 1975.

2524 METABOLIC INTERACTIONS OF GLUCOSE, ACETOACETATE AND ADRENALINE IN RAT SUBMAXILLARY GLAND IN VITRO. *(E.)* Thompson, M. P.; Williamson, D. H. (Radcliff Infirm., Oxford, England). *Biochem. J.* 146(3):635-644, 1975.

2525 EFFECT OF SECRETIN ON THE SECRETION OF ACID AND PEPSIN BY THE TOTALLY ISOLATED CANINE STOMACH. *(E.)* Kowalewski, K.; Kolodej, A. (Surg. Med. Res. Inst., Univ. Alberta, Edmonton, Canada). *Pharmacology* 12(1):57-63, 1974.

Totally isolated whole canine stomachs, perfused *ex vivo* with homologous blood, were used for study of the action of secretin on gastric secretion of acid and pepsin. During 8 hr of perfusion, stomachs were stimulated by constant infusion of 32 µg/hr of pentagastrin into gastric arteries of isolated organs. When base line secretion was established (after 3.5 hr), secretin, (60 U/hr) was also infused for 90 min into the gastric artery. Secretin injection was then interrupted, but pentagastrin infusion continued until the termination of the experiment. Secretin produced decreases of 60%, 74% and 36% in gastric secretory volume, acid output and acid concentration, resp., while stimulating pepsin output and concentration by 236% and 800%, resp. The maximal effect was seen after 30-60 min and persisted for 1-3 hr after secretin was discontinued. The dissociation of the effects of secretin on gastric acid and pepsin secretion in this system resembles the action of secretin on gastric secretion reported by others in various *in vivo* experiments.

2526 HISTAMINE RELEASE BY GASTRIC STIMULANTS. *(E.)* Rangachari, P. K. (Univ. California Sch. Med., San Francisco). *Nature* 253(5486):53-54, 1975.

The rates of histamine and acid release in response to pentagastrin, acetylcholine and dibutyryl cyclic AMP (cAMP) were studied in the isolated gastric mucosa of the bullfrog, *Rana catesbeiana*. Acid secretion from freshly mounted mucosa ranged from 6-10 µEq/hr but declined to resting levels of $\leq$ 2 µEq/hr over an 8-12 hr period, in spite of nutrient solution replenishment. Histamine release as determined by fluorometric analysis, decreased over the same period from about 500 ng/hr to a resting level of about 140 ng/hr. Addition of pentagastrin (5×10^{-6}M) or acetylcholine (10^{-3}M) to resting mucosa produced a 2-fold increase in the rates of both histamine and acid release, the peak of histamine release (15 min) preceeding that of acid secretion (25-30 min). Dibutyryl cAMP (5mM) produced a 5-fold increase in acid secretion but had no effect on histamine release. Acid secretion of resting mucosa was also stimulated by addition of nutrient solution incubated for 90 min with actively secreting mucosa. It is thus concluded that histamine released by frog gastric mucosa is responsible for stimulating acid secretion *in vitro* and that histamine is the common mediator for acetylcholine and pentagastrin in this system.

2527 EFFECT OF HISTAMINE ON IMMUNOREACTIVE GASTRIN IN GASTRIC JUICE AND IN SERUM. *(E.)* Stadil, F.; Malmstrom, J.; Miyata, M; Rehfeld, J. F. (Righosp., Copenhagen, Denmark). *Surgery* 77(3):345-350, 1975.

Gastric juices from 82 patients with various dyspeptic disorders were analyzed by radioimmunoassay for gastrin following histamine injection (0.04 mg/kg s.c.). Preliminary *in vitro* studies showed that gastrin added to untreated gastric juice decreased rapidly from 135 pg/ml to less than 10 pg/ml in less than 1 min. This could be prevented by boiling or neutralizing the gastric juice. None or only a trace amount of gastrin was found in untreated, boiled, or boiled and neutralized gastric juice in every patient, including 3 patients with achlorhydria. Histamine injection (0.04 mg/kg s.c.) did not influence this and was without effect upon serum gastrin concentrations of 9 duodenal ulcer patients. Because gastrin apparently is degraded rapidly by gastric juice, this study does not necessarily disprove that gastrin is secreted into the stomach. However, the virtual absence of gastrin in all specimens examined, including some collected directly upon boiling water bath during continuous gastric aspiration, lends no support to this speculation. Because gastrin does not survive even a short exposure to gastric juice without degradation, it is suggested that earlier reports on the presence of gastrin within the stomach are questionable.

2528 THE EFFECT OF OPTIMUM THERAPEUTIC DOSE OF POLDINE ON ACID SECRETION, GASTRIC ACIDITY, GASTRIC EMPTYING, AND SERUM GASTRIN CONCENTRATION AFTER A PROTEIN MEAL. *(E.)* Bieberdorf, F. A.; Walsh, J. H.; Fordtran, J. S. (Univ. Texas Southwest. Med. Sch., Dallas). *Gastroenterology* 68(1):50-57, 1975.

The effects of the optimum therapeutic dose of poldine on gastric function was studied in 5 normal volunteers. Five oz. of steak and a slice of toast and butter were homogenized, the pH set at 5.0, and infused into the stomach through a Levin tube. Acid secretion rate was measured for 3 hr after the meal by *in vivo* titration with $NaHCO_3$. To measure gastric pH and acidity, pH was measured by pH meter on a separate day. On a 3rd day of experiment, 5 g polyethylene glycol in 25 cc water were infused into the stomach 90 min after the meal. Stomach contents were then mixed and aspirated, and the stomach rinsed with saline and again aspirated, and the gastric volume and buffer content calculated. All experiments were done both with and without poldine. Poldine reduced acid secretion by 25-40% from 1 hr after the start of the experiment. Gastric acidity after poldine was reduced from 15% at 90 min to 50% after 180 min. Gastric volume and buffer content at 90 min were calculated to be 370 ml and 21 mEq, resp. It is concluded that the inhibition of gastric acidity by poldine is due to reduced secretion rather than to delayed emptying of food buffer.

2529 DEPLETION OF ANTRAL GASTRIN AFTER FOOD IN RATS. *(E.)* Reeder, D. D.; Watayou, T.;

Booth, R. A. D.; Thompson, J. C. (Univ. Texas Med. Branch, Galveston). *Am. J. Surg.* 129(1):67-70, 1975.

The effect of feeding on tissue gastrin values was studied in rat fundus, antrum and proximal small intestine. Sprague-Dawley rats (80) were fasted for 48 hr, fed, and in groups of 10 decapitated at 5, 10, 15, 20, 25, 30, and 40 min after feeding. Ten non-fed rats served as controls. Blood was immediately taken from the neck for radioimmunoassay, and the stomach, duodenum, proximal 5 cm of the jejunum and a specimen of the rectus abdominus muscle were removed. Serum gastrin concentrations in all fed rats were significantly higher than control values (269 pg/ml after 25 min and 160 pg/ml, resp.). Serum gastrin concentrations in the antrum were significantly less than control values (2690 ng/g at 5 min and 3850 ng/g at 15 min *versus* 6900 ng/g in fasting controls). Total gastrin content dropped from 1289 ng to 647 ng at 5 min, and to 428 ng at 30 min. In the gastric fundus the concentration increased from 9.7 to 21.8 ng/g in 40 min. Gastrin content increased from 12.5 to 28.1 ng. In the duodenum, gastrin-like immunoreactivity concentration rose from 77.2 to 260 ng/g after 25 min. Content rose significantly from a control value of 99.4 ng. It is concluded that in rats, feeding causes an abrupt increase in serum gastrin persisting for at least 40 min, that the fundus is a target organ, and the duodenum probably synthesizes gastrin. The antrum results suggest that early gastrin release may trigger a mechanism for synthesis that reacts cyclically with the release.

2530 ROLE OF BILE ACIDS IN THE PATHOGENESIS OF ASPIRIN-INDUCED GASTRIC MUCOSAL HEMORRHAGE IN RATS. *(E.)* Semple, P. F.; Russell, R. I. (R. Infirm., Glasgow, Scotland). *Gastroenterology* 68 (1):67-70, 1975.

The effect of combined aspirin and bile acids on gastric mucosal hemorrhage was studied in the rat. Sprague-Dawley rats were fasted 24 hr and fed acetylsalicylic acid in a 1% suspension of carboxymethylcellulose to which was added in different cases 5 mM of various bile acids in glucose saline. Controls were given equal parts of the acetysalicylic acid suspension and the glucose saline. All administered solutions had a pH of 4.5. The rats were killed 4 hr after administration and the stomachs removed and examined for hemorrhage. A dose of 64 mg/kg of acetylsalicylic acid was found to cause lesions in 32% of the rats, and this dose was then used in conjunction with taurocholic, taurodeoxycholic, glycholic, cholic, deoxycholic, or chenodeoxycholic acids. Significant findings were lesions in 82.4% of the rats treated with taurocholic acid, 64.3% with taurodeoxycholic acid, and 64.3% with glycholic acid. Bile acids used without acetylsalicylic acid had no effect. It is concluded that certain bile acids reduce the threshold for aspirin-induced gastric mucosal damage in the rat.

2531 THE EFFECT OF VAGAL STIMULATION ON GASTRIN RELEASE AND ACID SECRETION. *(E.)* Maher, J. W.; Wickbom, G.; Woodward, E. R.; McGuigan, J. E.; Dragstedt, L. R. (Coll. Med., Univ. Florida, Gainesville). *Surgery* 77(2):255-260, 1975.

Serum gastrin response to vagal stimulation was studied in 8 mongrel dogs with gastrointestinal continuity. Each dog was given a chronic esophageal fistula and a vagally-denervated fundic pouch. Six were later given an isolated vagally-innervated antral pouch and a gastroduodenostomy to reestablish continuity. Before and after the creation of the antral pouch the dogs were sham fed 500 g horsemeat after a 20 hr fast. The meal was constantly removed through the esophageal fistula and recycled for 30 min. Gastric juice was collected from the fundic pouches every 15 min for 1 hr before and 3 hr after each sham feeding, and the acid output determined. Blood for serum gastrin determination by radioimmunoassay was drawn just before sham feeding and hourly afterwards until the acid output returned to basal level. Preoperative sham feeding caused a gastric acid increase from 32-322 μEq/15 min and of serum gastrin from 32-43 pg/ml (the latter not statistically significant). After the antral pouches had been created, the basal serum gastrin level was unchanged but sham feeding caused a rise to 177 pg/ml which decreased to 89 pg/ml after 1 hr and 51 pg/ml by 3 hr. There was no significant change in the acid output. It is concluded that vagal gastrin release in sham fed dogs with gastrointestinal continuity is small or insignificant, and direct vagal stimulation of the parietal cells is the major mechanism in sham feeding-induced acid secretion.

2532 GASTRIN CELL HYPERPLASIA IN RATS WITH CHRONIC ANTRAL STIMULATION. *(E.)* Lehy, T.; Voillemot, N.; Dubrasquet, M.; Dufougeray, F. (INSERM, Beaujon Hosp., Clichy, France). *Gastroenterology* 68(1):71-82, 1975.

Topographic distribution of antral gastrin cells was studied in rats with antrocolic transpositions to verify whether colonic conditions could modify gastrin and other endocrine cell populations after acid feedback suppression. Wistar rats (9 males) were surgically prepared with transposition of total gastric antrum onto the colon, and provided with a gastric fistula in the rumen; 9 controls were given only the fistula. All were fasted for 18 hr. A blood sample was taken for radioimmunoassay and a 2 hr basal gastric secretory study was performed. The rats were killed 15 days after surgery, and the entire stomach and the antrum with its adjacent colon were fixed in Bouin's fluid. The specimens were cut into strips and adjacent sections studied by immunofluorescence and argyrophilic techniques, and by electron microscopy. The acid output of the operated rats (489 μEq/2 hr) showed a significant increase over that of the controls (130 μEq/2 hr), and gastrinemia was also significantly elevated (171 pg/ml for operated; 20 pg/ml for controls). In the operated rats, gastrin cells were found to be significantly more numerous than in the controls except in the strip closest to the pylorus. Values increased from 4.3 to 6.7 (esophagus to pylorus) in controls and remained between 7.1 and 7.2 in oper-

ated rats, dropping to 6.7 in the last strip nearest the ligation. The argyrophil cell count increased slightly toward the esophageal junction and decreased significantly in the middle 3rd of all strips, but mean counts were higher than those of controls. There was a 78% increase in gastrin cells/glandular tube, but the gastrin:argyrophil ratio was similar in both operated and control rats. Electron micrography also showed an increase in the number of all endocrine cells in the tubes. It is concluded that antrocolic transposition results in increases in density of both argyrophil and gastrin cells after 15 days.

2533 ABERRATIONS IN HOLLANDER TEST RESPONSE AFTER INCOMPLETE VAGOTOMY. COMPENSATING EFFECT OF ANTRAL RESECTION IN THE DOG. *(E.)* Vogel, S. B.; Orahood, R. C.; Eisenberg, M. M. (Dep. Surg., Univ. Minnesota, Minneapolis). *Am. J. Surg.* 129(1): 55-61, 1975.

The role of antral gastrin was evaluated in the response to Hollander vagal stimulation after partial vagotomy with either pyloroplasty or antrectomy. Fourteen mongrel dogs were given gastric fistulas and fasted 18 hr prior to experimental procedures. Response to vagal stimulus by i.v. insulin (0.2 U/kg) or 2-deoxy-D-glucose (200 mg/kg) or parietal cell stimulation by histamine infusion (0.16 mg/kg/hr) were tested. Gastric juice samples were collected every 30 min and the acidity determined. During vagal stimulation, venous blood samples were collected every 15 min for 1 hr and every 30 min subsequently. After control measurements were made, the dogs were given either an anterior vagectomy and pyloroplasty, or an anterior vagectomy and a Billroth I pylorus-preserving antrectomy, and the experiments were repeated. In the group given the pyloroplasty, there was a 19% reduction in acid response to both insulin and 2-deoxy-D-glucose from control values (12.05 and 13.18, resp.). The serum gastrin concentration was uniformly elevated over control values, but not to a significant degree. In the antrectomized group the peak acid outputs were 0.51 and 3.68 mEq after insulin and 2-deoxy-D-glucose, resp., representing reduction from control values of 96 and 67%, resp. Surgery had no apparent effect on histamine-induced acid secretion. It is concluded that the Hollander test may be inaccurate and misleading in vagotomy assessment in antrectomized patients.

2534 INFLUENCE OF PANCREATIC SECRETION ON GASTRIC SECRETION IN DOGS. *(E.)* Palasciano, G.; Tiscornia, O.; Dzieniszewski, J.; Sarles, H.; Vincent, J. P.; Lazdunski, M. (Dig. Pathol. Res. Unit, INSERM, Univ. Nice, France). *Digestion* 11(1/2):64-71, 1974.

The influence of pancreatic secretion on gastrin-stimulated gastric secretion was studied in dogs. Seven dogs were prepared with chronic gastric and duodenal fistulas; gastrin (6 μg/kg/hr) was continuously infused at a constant rate *via* a polyethylene catheter inserted into a leg vein. Pancreatic juice was collected and stored; gastric juice was collected after each 15 min period. When the plateau level of gastric secretion was reached (45-60 min), solutions of test material were infused into the second part of the duodenum and each successive 15 min period value was compared to the plateau level values of gastric secretion. Gastric secretion was significantly decreased after the administration of lyophilized pig pancreas (62%), pancreatic juice (57%), and bovine trypsinogen (33%). Intraduodenal administration of isotonic saline solution, lyophilized pig meat, trypsin, and chymotrypsinogen failed to decrease gastric secretion. The results indicate that exocrine pancreatic secretion decreases gastric secretion in dogs, and that the alkaline and protein components of the pancreatic secretion play a role in the duodenal regulation of pH; the alkaline component neutralizes the H^+ in the duodenum, and the protein component acts by means of the activation peptide of trypsinogen.

2535 INCREASED HISTIDINE AND DOPA DECARBOXYLASE ACTIVITY IN THE RAT STOMACH DURING RESTRAINT ULCER FORMATION. *(E.)* Schauer, A.; Kunze, E.; Feifel, G.; Permanetter, W.; Fraps, P. (Inst. Pathol., Univ. Munich, Germany). *Digestion* 11(1/2):12-24, 1974.

The activities of histidine decarboxylase and dopa decarboxylase (which produce the vasoactive histamine and dopamine) were determined radiometrically to investigate their possible relation with the development of gastric mucosal erosions in rats. Restraint stress was induced in 250 Wistar rats by enclosing their bodies in plaster casts. At 2 hr intervals for 3-30 hr, the stomachs were removed and the number, position, and diameter of mucosal erosions were determined; the glandular portions were minced, homogenized, and analyzed for both amino acid decarboxylases by a micromethod measuring liberated $^{14}CO_2$ radiometrically. In another series of restrained rats, histological examinations were done on sections of the glandular part of the stomach. On gross examination, erosions (almost exclusively in glandular part of stomach) were seen in 40% of the animals after 3 hr stress; the figure subsequently rose to 100% with increased duration of restraint. After 3 hr, the histidine decarboxylase showed a continuous increase in activity and attained a maximum of more than twice the control activity between 9 and 11 hr. The dopa decarboxylase activity was moderately raised until 11-13 hr after the beginning of immobilization and showed twice the activity after 13-15 hr. The activity of both amino acid decarboxylases decreased to below the normal level after 21 hr. The localization of histamine in the glandular portion of the stomach provided further argument for its participation in the formation of stress-induced erosions; the highest activity of histidine decarboxylase was also found in that area. Interpretation of the increase of dopa decarboxylase is speculative, and the need for further investigation is stressed.

2536 EFFECT OF NICOTINE HYDROGEN TARTRATE ON GASTRIC SECRETION OF NORMAL AND VAGOTOMIZED

RATS STIMULATED WITH HISTAMINE PENTAGASTRIN AND BETHANECHOL CHLORIDE. *(E.)* Kowalewski, K. (Surg.-Med. Res. Inst., Univ. Alberta, Edmonton, Canada). *Digestion* 10(6):393-401, 1974.

Wistar rats with permanent gastric fistulas, some of which had been vagotomized, were given acute and chronic infusions of nicotine to determine its effect on 24-hr output of HCl and pepsin. Secretion was stimulated by constant i.v. infusion of histamine, pentagastrin, or bethanechol chloride. Nicotine hydrogen tartrate was used in acute and chronic experiments. An i.v. infusion (240 µg/kg) for 24 hr with simultaneous collection of gastric juice demonstrated the inhibitory action of this drug on basal secretion and secretion stimulated with histamine (100 mg/kg), pentagastrin (768 µg/kg), and bethanechol chloride (2.5 mg/kg). Inhibition affected the output of HCl and pepsin, also the concentration of HCl. In non-stimulated and in bethanechol-stimulated rats, nicotine hydrogen tartrate also decreased the concentration of pepsin. Chronic treatment (given s.c.) induced the inhibition of gastric secretion under various stimulation conditions. The vagotomy-induced decrease in response to the stimulants was further reduced when nicotine hydrogen tartrate was added to the stimulants. The authors suggest the possibilities that nicotine hydrogen tartrate may directly affect chief cells of gastric glands in rats or alter the responsiveness of the cells to humoral and cholinergic stimulants.

2537 INFLUENCE OF THE PROXIMAL SMALL INTESTINE ON THE GASTRIC HYPERSECRETION IN PYLORUS-LIGATED RATS. *(E.)* Okabe, S.; Takeuchi, K.; Nakamura, K.; Takagi, K. (Fac. Pharm. Sci., Univ. Tokyo, Japan). *Am. J. Dig. Dis.* 20(2):138-147, 1975.

The mechanism of gastric-secretory inhibition caused by the simultaneous ligation of upper and lower duodenum, jejunum, or bile duct was studied in pylorus-ligated Donryu rats. Additional experiments were done, including treatment with atropine sulfate (10 mg/kg s.c.) 30 min before pylorus-ligation and acidification of the duodenum with 2 ml 0.1 N HCl. The animals were killed (3-7 hr after experiments) and gastric contents collected and centrifuged. Determinations were made for pH, total acid output, and pepsin activity; the intestinal contents were examined quantitatively for volume and pH. The simultaneous ligation of individual points of the proximal small intestine, especially the end of the duodenum, in pylorus-ligated rats caused significant inhibition of gastric secretion (volume, acidity, and acid output). The participation of biliary secretion was negligible. The study suggests that several parts of the proximal small intestine appear to have pressure receptors which lead to the inhibition of gastric secretion and that the inhibition is independent of cholinergic nervous blocking and independent of hormonal influence (assumed to be produced by intestinal acidification); the need for further study is stressed.

2538 INVESTIGATION OF THE VASODILATOR AND ANTI-SECRETORY ROLE OF PROSTAGLANDINS IN THE RAT GASTRIC MUCOSA BY USE OF NON-STEROIDAL ANTI-INFLAMMATORY DRUGS. *(E.)* Main, I. H. M.; Whittle, B. J. R. (Sch. Pharm., Univ. London, England). *Br. J. Pharmacol.* 53(2):217-224, 1975.

The effects of non-steroidal anti-inflammatory drugs on gastric acid secretion and mucosal blood flow were studied in the rat to test the hypothesis that prostaglandins have a physiological role as negative feed-back inhibitors of acid secretion and as vasodilators in the gastric mucosa. The relation between inhibition of prostaglandin synthesis and the formation of mucosal erosions was also investigated. Acid output into the perfused gastric lumen was measured and mucosal blood flow determined simultaneously in Wistar rats. Following drug treatment, the rats were killed at various time intervals and the stomachs removed. Erosions, which formed only in the glandular mucosa, were counted and rated for severity. During resting conditions, indomethacin (30 mg/kg i.v.) had no significant effect on acid output, but reduced mucosal blood flow. When given in ulcerogenic doses (20 and 40 mg/kg), it caused a dose-dependent rise in pentagastrin-stimulated acid secretion, but decreased mucosal blood flow/U acid secretion. Pretreatment with indomethacin, phenylbutazone, or meclofenamate potentiated the secretory response to dibutyryl cyclic adenosine 3',5'-monophosphate. Indomethacin significantly reduced the mucosal prostaglandin-like activity at a time when mucosal erosion formation had reached steady levels. These results provide evidence that prostaglandins have a local role in the regulation of blood flow and acid secretion in the rat gastric mucosa, and suggest that non-steroidal anti-inflammatory drugs cause mucosal erosions by disrupting these processes.

2539 THE EFFECTS OF BURIMAMIDE AND METIAMIDE ON BASAL GASTRIC FUNCTION IN THE CAT. *(E.)* Harris, D. W.; Smy, J. R.; Reed, J. D.; Venables, C. W. (Dep. Pharm., Sunderland Polytech., England). *Br. J. Pharmacol.* 53(2):293-297, 1975.

The effects of burimamide and metiamide on basal gastric acid secretion and blood flow in the anesthetized cat and on acid secretion in the conscious cat were investigated. Burimamide or metiamide (2 mg/kg) was administered as a single i.v. injection, and gastric acid output was determined at 15 min intervals. In eight anesthetized cats, burimamide caused a 5-fold increase of acid secretion (30.9-150.9 µEq H^+/15 min) and increased mucosal blood flow 46% (18.7-27.4 ml/15 min). In nine conscious cats, the same dose of burimamide also increased acid secretion (24.1-174.1 µEq H^+/15 min). Metiamide, in six anesthetized cats, decreased acid secretion (51-0.8 µEq H^+/15 min) and mucosal blood flow (22.9-13.3 ml/15 min). When metiamide was given in a dose which inhibits pentagastrin-stimulated acid secretion (4 mg/kg i.m.) to six conscious cats, no significant changes were observed. Metiamide did not influence the amount of acid which diffused out of the stomach when instilled at pH 1.5-6.0. It is suggested that in increasing basal gastric secretion, burimamide stimulates acid secretion in the previously unstimulated stomach through release of some intermediary substance.

2540 SODIUM LOCALIZATION IN NORMAL, PENTAGASTRIN-STIMULATED AND SECRETIN-INHIBITED RAT GASTRIC MUCOSA. *(E.)* Kalahanis, N. G.; Das Gupta, T. K.; Nyhus, L. M. (Univ. Illinois Coll. Med., Chicago). *Fed. Proc.* 34(3):453, 1975.

2541 EFFECT OF AUTONOMIC BLOCKING AGENTS ON HISTAMINE AND TETRAGASTRIN INDUCED HCl SECRETION IN DOGS. *(E.)* Evans, D. C.; Lin, T. M. (Lilly Res. Lab., Indianapolis, Indiana). *Fed. Proc.* 34(3):442, 1975.

2542 EFFECTS OF AGONISTIC AND ANTAGONISTIC DRUGS OF THE ALPHA AND BETA RECEPTORS ON FROG GASTRIC MUCOSA. *(E.)* Farmer, J. M.; Carrasquer, G.; Holloman, T. L.; Schwartz, M. (Dep. Med., Univ. Louisville, Ky.). *Fed. Proc.* 34(3):442, 1975.

2543 ANALYSIS OF PENTOSE PHOSPHATE SHUNT IN RAT AND FROG GASTRIC MUCOSAE. *(E.)* Sernka, T. J. (Louisiana State Univ. Med. Cent., Shreveport). *Comp. Biochem. Physiol.* [B] 50(2):351-353, 1975.

2544 EFFECTS OF HYPOPHYSECTOMY AND GROWTH HORMONE ON SERUM AND ANTRAL GASTRIN. *(E.)* Enochs, M. R.; Johnson, L. R. (Univ. Texas Med. Sch., Houston). *Fed. Proc.* 34(3):441, 1975.

2545 HEPATIC AND MESENTERIC METABOLISM OF C-TERMINAL PENTAPEPTIDE OF GASTRIN IN THE RAT. PART II. PATHWAYS OF PENTAGASTRIN INACTIVATION IN THE RAT. *(E.)* Varro, V.; Nafradi, J. (Univ. Med. Sch., Szeged, Hungary). *Acta Hepato-gastroenterol. (Stuttg.)* 21(6):441-445, 1974.

2546 ACID SECRETION FROM THE ISOLATED PERFUSED CANINE STOMACH. *(E.)* Pilot, M. A. (London Hosp. Med. Coll., England). *J. Physiol. (Lond.)* 245 (2):104P-105P, 1975.

2547 GASTRIC SECRETION OF THE RABBIT AND THE TWO-COMPONENT HYPOTHESIS. *(Fr.)* Beauville, M.; Raynaud, P.; Vernay, M. (Inst. Physiol., Paul Sabatier Univ., Toulouse, France). *Biol. Gastroenterol. (Paris)* 7(3):215-219, 1974.

2548 ALKALINE GASTRIC SECRETION AND INTERSTITIAL PRESSURE. *(E.)* Altamirano, M.; Requena, M.; Perez, T. (J.M. Vargas Sch. Med., Cent. Univ. Venezuela, Caracas). *Fed. Proc.* 34(3):453, 1975.

2549 EFFECT OF ELECTRICAL STIMULATION OF THE HYPOTHALAMIC FEEDING AREA ON GASTRIC SECRETION IN CATS. *(E.)* Wyrwicka, W. (VA Wadsworth Hosp. Cent., Los Angeles, Calif.). *Fed. Proc.* 34(3): 441, 1975.

2550 THE GASTRIC RESPONSE TO SUBDIAPHRAGMATIC ELECTRICAL STIMULATION OF THE VAGUS NERVES IN THE ANESTHETIZED CAT. *(E.)* Bauer, R. F.; Adair, L. S.; Brooks, F. P. (no affil.). *Fed. Proc.* 34(3): 441, 1975.

2551 EVIDENCE OF NON-VAGAL NEURAL STIMULATION OF CANINE GASTRIC ACID SECRETION. *(E.)* Tansy, M. F.; Probst, S.; Martin, J. S. (Temple Univ. Health Sci. Cent., Philadelphia). *Fed. Proc.* 34(3):441, 1975

2552 STUDIES ON THE INHIBITION OF STIMULATED GASTRIC SECRETION BY INTRADUODENAL ADMINISTRATION OF FATTY ACIDS. *(Ger.)* Schmidt-Wilcke, H. A.; Steinhagen, E.; Steinhagen, P.; Lapp, M. (Med. Clin., Univ. Marburg, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:873-876, 1973.

2553 THE EFFECT OF INTRAGASTRIC CALCIUM ON GASTRIC JUICE SECRETION IN HUMANS. *(Ger.)* Holtermuller, K. H.; Go, V. L. W. (Mayo Clin., Rochester, Minn.). *Verh. Dtsch. Ges. Inn. Med.* 79: 832-834, 1973.

2554 INHIBITION OF GASTRIC SECRETION IN DOGS BY A SYNTHETIC PROSTAGLANDIN (PGE_2). *(E.)* Mihas, A.; Gibson, R.; Hirschowitz, B. I. (Univ. Alabama Med. Cent., Birmingham). *Fed. Proc.* 34(3): 442, 1975.

2555 GASTRIC ACID SECRETION AND ULCEROGENESIS IN CYSTEAMINE-TREATED RATS. *(E.)* Wilder, D. E.; Hohnke, L. A. (Pfizer Cent. Res., Groton, Conn.). *Fed. Proc.* 34(3):442, 1975.

2556 ULTRASTRUCTURAL CHARACTERIZATION OF PROPIONITRILE-INDUCED DUODENAL ULCER IN THE RAT. *(E.)* Giampaclo, C.; Feldman, D.; Reynolds, E. S.; Dzau, V. J.; Szabo, S. (Peter Bent Brigham VA Hosp., Boston, Mass.). *Fed. Proc.* 34(3):227, 1975.

2557 EFFECT OF ANTACIDS ON ACID BINDING AND GASTRIN LIBERATION IN MAN. *(Ger.)* von Berger, L.; Dollinger, H. C.; Raptis, S. (Cent. Intern. Med. Pediatr., Univ. Ulm, Germany). *Z. Gastroenterol.* 13(1):5-11, 1975.

See also, 2454, 2505, 2515, 3020, 3024, 3057, 3059, 3062, 3063, 3064, 3065.

2558 THE EFFECT OF CHRONIC HYPERGASTRINEMIA ON THE PANCREAS OF THE RAT. *(Fr.)* Chariot, J.; Lehy, T.; Nasca, S.; Dubrasquet, M. (Bichat Hosp., Paris, France). *Biol. Gastroenterol. (Paris)* 7:221-236, 1974.

The weight of the pancreas, its total DNA content, pancreatic enzyme activities and total protein, and pancreatic enzyme secretion were measured on fasting male Wistar CF rats with chronic hypergastrinemia induced by antrocolonic transposition. Controls consisted of intact rats, rats with gastric fistulas, and antrectomized rats. Studies were performed 14, 30, and 45 days and 6 months after antrocolonic transposition. Chronic hypergastrinemia had no effect on the weight of the pancreas. In comparison to the controls, total pancreatic DNA was significantly increased in rats with chronic hypergastrinemia 30 and 45 days and 6 months after surgery, while enzyme activities in pancreatic homogenates were decreased in some cases. At 14 days after surgery, pancreatic secretion of amylase, lipase, trypsin, and chymotrypsin did not differ significantly in rats with hypergastrinemia and those with gastric fistula and antrectomies. Areas of pancreatitis, which increased in frequency and severity with the time after surgery, were observed in rats with hypergastrinemia. A slight weight gain 6 months after antrocolonic transposition suggests that nutritional disorders accompany antrocolonic transposition and make long-term results more difficult to interpret. These results differ from those obtained previously by long-term treatment with pentagastrin. These discrepancies might be due to differences in the nature of the gastrin stimulants, gastrin doses, and ages of the rats. It is concluded that pancreatic secretion in the rat is not significantly affected by gastrin stimulation.

2559 THE ELECTROGENIC SODIUM PUMP IN THE HYPERPOLARIZING AND SECRETORY EFFECTS OF PANCREOZYMIN IN THE PANCREATIC ACINAR CELL. *(E.)* Kanno, T. (Fac. Vet. Med., Hokkaido Univ., Sapporo, Japan). *J. Physiol. (Lond.)* 245(3):599-616, 1975.

The hyperpolarizing effect of pancreatic secretagogues on pancreatic acinar cells was studied, along with the mechanism involved in the effect of pancreozymin on the acinar membrane potential. The transmembrane potential, effective membrane resistance, and amylase release were recorded simultaneously from the acinar cells of rat pancreas (taken from young male Wistar rats) perfused with Krebs-Henseleit solution. Continuous stimulation with 5 U pancreozymin/ml perfusing solution produced the highest and most prolonged amylase output, confirming the hyperpolarizing effect of the secretagogue. The hyperpolarizing effect disappeared under conditions of low ambient temperature, the absence of K^+, low Na concentrations, and in the presence of ouabain (10^{-5} M). In these environments, particularly with high concentrations of pancreozymin (200 U/ml), transient depolarization was frequently observed immediately after stimulation. All of these conditions which inhibited the secretory effect of pancreozymin are known to suppress the electrogenic Na pump. When a Krebs-Henseleit solution containing pancreomyzin was used to bathe the sectioned pancreas for 1 hr and then used to perfuse an isolated, non-sectioned pancreas, the bathing solution depolarized the acinar cells and decreased the effective membrane resistance. An increase in amylase release was observed at the initial perfusion with the bathing medium, but was not seen at the second perfusion. It is suggested that pancreozymin acts on the basal side of the membrane of the pancreatic acinar cell to produce dual effects. An increase in Na^+ and Ca^{2+} permeabilities leads to a rise in $[Ca^{2+}]_i$ which initiates the release of enzyme, and enhancement of the electrogenic Na pump maintains the Ca-influx and the consequent enzyme release.

2560 ATROPINE AND EXOCRINE PANCREATIC SECRETION IN ALCOHOL-FED DOGS. *(E.)* Tiscornia, O. M.; Palasciano, G.; Sarles, H. (Res. Unit Dig. Pathol., INSERM, Marseille, France). *Am. J. Gastroenterol.* 63(1):33-36, 1975.

The mechanism by which the stimulation of pancreatic secretion is triggered by acute i.v. ethanol in alcohol-fed dogs was studied. Five dogs were provided with chronic pancreatic and gastric fistulas (Thomas cannula). Ethanol (2 gm/kg diluted to 50% in isotonic saline) was administered daily through the gastric cannula, and the effects of acute i.v. ethanol injection (1.3 gm/kg) on the exocrine pancreatic secretion was tested before and 1.5, 3, 9, 12, and 17 months after the start of chronic alcohol intoxication. In all dogs, including one which had been subjected to truncal vagotomy, acute ethanol treatment elicited a rise in all cholecystokinin- and secretin-stimulated pancreatic secretion plateau values, particularly protein output. Cholinergic blockade by a continuous i.v. infusion of atropine inhibited primarily the protein component in the cholecystokinin- and secretin-stimulated juice. Atropine (1 mg/hr) superimposed on continuous secretin (1 CU/kg/hr) and CCK (3 u/kg/hr) injection prevented the excitatory effects of acute ethanol infusion on pancreatic secretion. Similar results had previously been found with the ganglionic blocking agent pentolinium. The data indicate that when given to alcohol-treated dogs, acute i.v. ethanol exerts its stimulatory effect on 'pancreon' *via* a cholinergic mechanism. This would be triggerd by stimulation of the parasympathetic hypothalamic centers and/or the autonomic intrapancreatic ganglia.

2561 EXOCRINE PANCREATIC FUNCTION IN URAEMIC RATS. *(E.)* Fleischer, K.; Kasper, H. (Med. Clin., Univ. Wurzburg, Germany). *Acta Hepatogastroenterol. (Stuttg.)* 21(6):398-403, 1974.

The exocrine pancreatic function in uremic rats was studied *in vivo* at 35 and at 100 days after 80-85%

nephrectomy. Exocrine pancreatic secretion was stimulated by continuous infusion of 25 U/kg/hr of secretin and 25 U/kg/hr of pancreozymin; pancreatic juice was collected at hourly intervals after cannulation of the pancreatic duct. The volume secreted in the uremic animals at 35 days increased by 83% during the first hr and 109% the second hr; the protein concentration and enzyme activities decreased, 39% for protein and 33% for lipase activity during the second hr. In animals which had been uremic for 100 days, pancreatic secretion was unchanged compared with controls. The hypersecretion of the exocrine pancreas in the initial phase of uremia appears to reflect the initial lesions of the exocrine pancreas.

2562 SECRETION OF CALCIUM IN PANCREATIC JUICE. *(E.)* Ceccarelli, B.; Clemente, F.; Meldolesi, J. (Dep. Pharmacol., Univ. Milan, Italy). *J. Physiol. (Lond.)* 245(3):617-638, 1975.

The origin of the calcium secreted by the pancreas was studied *in vivo* by analyzing the pancreatic juice secreted by the guinea pig in response to stimulation with secretin or cerulein, and by analyzing on a subcellular level the relation of the pancreatic tissue to its calcium secretory activity. Juice was collected from the cannulated pancreatic ducts of pentobarbitone-anesthetized male albino guinea pigs, into which tracers and secretagogue drugs were injected i.v. In agreement with previous findings, the concentration of calcium was low in the secretin-stimulated and high in the cerulein-stimulated juice. In the latter, calcium was proportional to protein. Following ^{45}Ca injection, the radioactivity in the blood plasma decreased rapidly and quasi-exponentially. The concentration of tracer in the secretin-stimulated juice remained relatively stable, at a level 1/3-1/4 of that in the plasma, whereas the concentration was 4- to 8-fold higher in the cerulein-stimulated juice. Switching from one type of secretion stimulation to the other resulted in a rapid shift in the level of radioactivity in the juice. In the secretin-stimulated juice, the time course of the juice:plasma radioactivity ratios observed after injection of $[^{3}H]$D-sorbital and ^{45}Ca were almost parallel. In the cerulein-stimulated juice, the ^{45}Ca ratios were at first lower than the corresponding $[^{3}H]$D-sorbital ratios. After 30 min they rose to very high values, the increase being followed by the appearance of newly synthesized $[^{3}H]$L-leucine-labeled proteins. The pancreatic tissue was rich in calcium, which was localized primarily in the zymogen granules and mitochondria; the soluble cytoplasm was low in calcium. The injected ^{45}Ca accumulated in the zymogen granules faster than the $[^{3}H]$L-leucine-labeled proteins. The ^{45}Ca:protein ratio of these organelles was considerably lower than that of the cerulein-stimulated juice. It is concluded that: 1) calcium is secreted into the pancreatic juice in two fractions, one associated with the electrolyte component, and the other with the juice protein; 2) zymogen granules are the major source of the latter fraction; and 3) the zymogen granule-associated calcium joins the exportable proteins some time after their synthesis.

2563 CALCIUM AND PANCREATIC SECRETION. I. SUBCELLULAR DISTRIBUTION OF CALCIUM AND MAGNESIUM IN THE EXOCRINE PANCREAS OF THE GUINEA PIG. *(E.)* Clemente, F.; Meldolesi, J. (Cent. Cytopharmacol., Natl. Res. Counc., Milan, Italy). *J. Cell. Biol.* 65(1):88-102, 1975.

Combined cytochemical and cell fractionation techniques were used to study the intracellular distribution of calcium in the guinea pig pancreas. Pancreatic homogenates and cell fractions from fasted male albino guinea pigs were assayed for calcium, magnesium, protein, cytochrome c oxidase, trypsin, and chymotrypsin. Most of the magnesium was associated with the rough microsomes (probably bound to the ribosomes) and the postmicrosomal supernatant of the acinar cells. Calcium was distributed among all particulate fractions, primarily the mitochondria, microsomes (especially smooth surfaced), zymogen granules, and the plasmalemma; it was found in low concentrations in the postmicrosomal supernatant. Most of the calcium recovered from the particulate reactions was membrane bound, the highest concentrations found in the membranes of the zymogen granules and in the plasmalemma. In control experiments, ^{45}Ca was added to the homogenization fluid during cell fractionation to determine the total amount of calcium artifactually adsorbed by each fraction. The results indicated that a considerable redistribution of calcium occurs during homogenization and cell fractionation. At least some of the resulting artefacts were estimated quantitatively and corrected calcium concentration data were obtained by subtracting the adsorbed calcium from the total calcium of the various fractions. The biochemical results were confirmed using the cytochemical antimonate technique carried out on the tissue and on isolated fractions. The results indicate that at least some of the calcium bound to the zymogen granule membrane might have a role in anchoring the membrane to the granule content, in preventing the activation of proteolytic zymogens within the granules, and in switching the conditions for the activation of the proteolytic zymogens from unfavorable, as in the zymogen granules, to favorable, as in the intestinal lumen.

2564 EXOCRINE PANCREATIC FUNCTION IN PROTEIN-DEFICIENT PATAS MONKEYS STUDIED BY MEANS OF A TEST MEAL AND AN INDIRECT PANCREATIC FUNCTION TEST. *(E.)* Gyr, K.; Wolf, R. H.; Imondi, A. R.; Felsenfeld, O. (Tulane Univ. Delta Primate Res. Cent., Covington, La.). *Gastroenterology* 68(3):488-494, 1975.

The influence of moderate protein deficiency and depletion on the exocrine pancreas was investigated in patas monkeys. Base line pancreatic function tests were performed while male and female monkeys were maintained on an adequate diet. Subsequently, they were put on a protein-free diet, and pancreatic function was again measured when the serum albumin had dropped to 2.8 g/100 ml or less. Pancreatic function was estimated by measuring enzymatic activities in the duodenal contents after a test meal and by determination of the urinary excretion of p-aminobenzoid acid (pancreatic function test) after oral

ingestion of the chymotrypsin-labile peptide *N*-benzoyl-L-tyrosyl-*p*-aminobenzoic acid. The plasma proteins decreased rapidly during the first 2 weeks on the protein-free diet, after which the globulin concentration leveled off at 2.9 g/100 ml. The albumin level continued to drop slowly, reaching 2.8 g/100 ml after 13.8 weeks. In five animals, protein deficiency caused no clinical symptoms except weight loss. In the other four monkeys, anorexia and hair loss were noted; two of these animals died and both showed atrophy of the pancreatic acinar cells. Significant decreases in the trypsin, lipase, amylase, and chymotrypsin activities of the duodenal samples were observed during protein deficiency. The urinary excretion of *p*-aminobenzoic acid was also significantly reduced. The two tests of pancreatic function correlated well. The data indicate that exocrine pancreatic secretion can be seriously impaired even at a moderate level of protein deficiency and that it may not always be reversible. Therefore, function tests must be evaluated with caution when hypoproteinemia is present.

2565 SECRETION OF IMMUNOREACTIVE GASTRIN FROM THE ISOLATED, PERFUSED CANINE PANCREAS. *(E.)* Rehfield, J. F.; Iversen, J. (Bispebjerg Hosp., Copenhagen, Denmark). *Horm. Metab. Res.* 6(4):260-264, 1974.

The concentration of immunoreactive gastrin was measured radiochemically in the perfusate from 11 perfusions of the isolated canine pancreas using rabbit antibodies raised against synthetic human gastrin. In 9 of 11 perfusions the concentration of immunoreactive gastrin was measurable (basal level, 7 pM/liter). During 10 min perfusions with arginine hydrochloride (1 mM/liter) and acetylcholine (10 μM/liter), immunoreactive gastrin concentrations rose to 4.5 and 7 pM/liter above the basal level, resp. Infusion of atropine in a concentration of 25 μM/liter prior to and during 2 infusions with acetylcholine lowered immunoreactive gastrin concentration from 8.4 to 5.0 pM/liter. Atropine did not prevent the stimulation of immunoreactive gastrin release by acetylcholine (10 μM/liter for 10 min). Alteration of glucose concentrations in the perfusion medium from 1.4 to 8.3 and later to 16.7 mM/liter had no effect on immunoreactive gastrin concentrations. Epinephrine (10 nM/liter) did not stimulate immunoreactive gastrin secretion. It was concluded that immunoreactive gastrin is present and may be released from the canine pancreas in response to cholinergic and aminogenic stimuli.

2566 CHRONIC ALCOHOLISM AND THE GASTRIN PHASE OF PANCREATIC SECRETION. *(Fr.)* Palasciano, G.; Tiscornia, O. M.; Dzieniszewski, J.; Teixeira, A. S.; Cavarzan, A.; Sarles, H. (Res. Unit Gastrointest. Dis., INSERM, Marseille, France). *Biol. Gastroenterol. (Paris)* 7:209-213, 1974.

The effect of 15% ethanol (1.3 g/kg p.o. through a stomach tube) on pancreatic secretion was studied in 3 dogs which had been given alcohol (2 g/kg/day p.o. through a stomach tube) for 2 yr and in 5 controls. All the dogs had gastric and duodenal fistulas. The gastric fistula was left open during the experiments to prevent the gastric contents from entering the duodenum. When pancreatic secretion was stimulated with secretin (1.0 U/kg/hr) and cholecystokinin-pancreozymin (3.0 U/kg/hr), infused simultaneously i.v., acute administration of ethanol significantly increased the pancreatic protein output in both groups of dogs. The protein output increased 70.9% in alcohol-fed dogs and 46.0% in controls. Increases also occurred in the volume of secretion, bicarbonate output, and protein concentration. Increases in the volume of secretion and the protein concentration were only significant for alcohol-fed dogs, while the increase in bicarbonate output was not significant in either group. The findings in this and previous studies suggest that increased secretion of pancreatic proteins, which is characteristic of the alcoholic pancreas, is due more to increased release of cholecystokinin-pancreozymin than to release of gastrin.

2567 EFFECTS OF CHRONIC ALCOHOLISM ON THE SYNTHESIS OF PANCREATIC ENZYMES IN THE RAT BEFORE AND AFTER ENDOGENOUS STIMULATION OF SECRETION. *(Fr.)* Dagorn, J. C.; Figarella, C.; Michel, R.; Sarles, H. (Res. Unit Gastrointest. Dis., INSERM, Marseille, France). *Biol. Gastroenterol. (Paris)* 7:201-208, 1974.

The rate of pancreatic enzyme synthesis and pancreatic enzyme activities were measured in water- and alcohol-fed fasting male Wistar CF rats given balanced and high-fat diets after pancreozymin-like stimulation by p.o. instillation of 2 ml oleic acid. Amylase, lipase, and potential chymotrypsin activities were measured on supernatant from pancreatic homogenates, and the rate at which ^{14}C-valine was incorporated into total pancreatic protein was measured on the homogenates themselves. Alcoholic rats received 20% alcohol *ad libitum* in place of drinking water for 2 or 8 months and either a high-fat or balanced diet. Before oleic acid stimulation the rate at which pancreatic proteins were synthesized was essentially the same in alcoholic and water-fed rats given balanced or high-fat diets, but the activities of all 3 pancreatic enzymes were increased in alcoholic rats. The rate of protein synthesis decreased significantly in alcoholic rats fed a high-fat diet 60 min after administration of oleic acid. This decrease was observed after 2 months of a high-fat diet but was more pronounced after 8 months. No significant change in the rate of protein synthesis occurred in the remaining 3 groups of rats (high-fat diet and water, balanced diet and water, and balanced diet and alcohol) after oleic acid stimulation. The decrease which occurred in pancreatic enzyme activity after oleic acid stimulation was less pronounced in alcoholic rats than in those given water, but this difference was not significant. Changes in the rate of pancreatic protein synthesis appear to be preceded by changes in the response of the pancreas of alcoholic rats to stimulation, confirming results obtained previously on dogs.

2568 PANCREATIC ACINAR CELLS: IONIC DEPENDENCE OF ACETYLCHOLINE-INDUCED MEMBRANE POTENTIAL AND RESISTANCE CHANGE. *(E.)* Nishiyama, A.; Peterson, O. H. (Inst. Med. Physiol. C, Univ. Copenhagen, Denmark). *J. Physiol. (Lond.)* 244(2): 431-465, 1975.

Current-voltage relations and the effect of ion replacements on the potential and resistance changes evoked by adding acetylcholine to the bathing fluid of isolated segments of mouse pancreas were investigated by injecting rectangular de- or hyperpolarizing current pulses through the recording microelectrode. Within a relatively wide range (-20 to -70 mV) there was a linear relation between injected current and change in membrane potential. The slope of such linear curves corresponded to an input resistance of about 3-8 MΩ. The membrane time constant was about 5-10 msec. Acetylcholine depolarized the cell membrane and caused a marked reduction of input resistance and time constant. The minimum latency of the acetylcholine-induced depolarization (applied locally to pancreatic acini by micro-iontophoresis) was 100-300 msec. Maximal depolarization was about 20 mV. The effect of this local acetylcholine application was abolished by atropine (1.4×10^{-6} M). The blocking effect of atropine was fully reversible. Replacing the superfusion fluid Cl by sulfate or methylsulfate caused an initial short-lasting depolarization. The amplitude of the acetylcholine-induced depolarization was enhanced in this state. Replacing extracellular Na by Tris caused an initial short-lasting hyperpolarization. In the steady state the resting potential was slightly lower than normal. The depolarizing effect of acetylcholine was immediately reduced as was the acetylcholine-induced change in resistance. Adding ethylene glycol-bis-(β-amino ethyl ester)N,N'-tetro acetic acid to a normal Na-containing Ca-free solution depolarized the cell membrane by about 5-10 mV and reduced the input resistance. Acetylcholine still evoked marked depolarization and reduction of input resistance. Omitting K from the superfusion fluid caused a slight cell membrane hyperpolarization. Acetylcholine caused a marked depolarization and resistance reduction. Readmitting K to a K-free solution after several hr of K deprivation caused a very marked hyperpolarization (20-30 mV) not accompanied by any change in input resistance or time constant. It is concluded that acetylcholine acts on the acinar cells by increasing the conductance of the plasma membrane to Na and K and possibly also to other ions. There is, however, no evidence for an acetylcholine-induced change in membrane Ca conductance. The importance of extracellular Ca may be the control of the $P_{Na}:P_K$ ratio.

2569 EFFECT OF AGE AND LONG-TERM DIET ON EXOCRINE PANCREAS OF THE RAT. *(E.)* Snook, J. T. (Dep. Hum. Nutr. Food, Cornell Univ., Ithaca, N.Y.). *Am. J. Physiol.* 228(1):262-268, 1975.

The effects of age and diet on rat pancreas enzyme and nucleic acid levels were analyzed in experiments designed to investigate pancreas composition and function between weaning and senescence, and possible factors responsible. Male Charles River rats were maintained on commercial cereal chow, were fed a stimulatory test diet of 15% whole egg protein for 1 week prior to killing by chloroform, and the pancreas was extracted. Pancreas weight, nucleic acid levels and pancreatic enzyme levels were measured. Pancreas weight declined from 0.78% at 4 weeks to 0.35% at 1 yr as a proportion of body weight. At 28 months, average body weight was 200 g less than that of 19-month-old rats while pancreas weight and total DNA were significantly greater compared to 12-month-old rats. Pancreatic lipase, chymotrypsinogen and trypsinogen were reduced more than 65% in 28- as compared to 12-month-old rats; amylase had disappeared. The decline in enzymes occurred sometime after 19 months. In the second experiment semipurified diets high in sucrose, starch or butterfat were fed to rats from 9-24 months of age. The physiological condition of rats in the fat and sucrose group appeared poorer than 28-month-old rats in the first experiment. The high fat diet rats had significantly less chymotrypsinogen and trypsinogen than 9-month-old control groups, while the sucrose, starch and 9-month-old control groups did not differ significantly in total enzyme content. Enzyme concentrations were generally lower in aged rats; this was compensated for by increase in pancreas size. Digestion of whole egg protein (3 g/day) was not impaired even in rats with a 50-70% reduction in total pancreatic protease, in agreement with previous findings that a decrease in the functional reserve capacity of the pancreas may not be of metabolic significance.

2570 EFFECTS OF CHRONIC ETHANOL ADMINISTRATION ON CANINE EXOCRINE PANCREATIC SECRETION. FURTHER STUDIES. *(E.)* Tiscornia, O.; Palasciano, G.; Sarles, H. (Res. Unit Dig. Pathol., INSERM, Marseille, France). *Digestion* 11(3/4):172-182, 1974.

Ethanol-induced modifications of pancreatic secretion in the dog were studied up to one year's exposure. Five dogs were given chronic pancreatic fistulae, the accessory duct ligated in each case, and Thomas cannulas were inserted into the stomach. After an 18 hr fast the major pancreatic duct was cannulated and the secretion collected at 20 min intervals. Ethanol and secretin (1.0 CU/kg/hr) alone or combined with cholecystokinin (3.0 U/kg/hr) were infused into the saphenous veins. After standardization, 2.0 g/kg 50% ethanol in isotonic saline was administered by the gastric cannula at the same hr daily. Pancreatic secretory response to acute i.v. ethanol infusion was determined by two methods. In one, under continuous perfusion of secretin, a 1.3 g/kg infusion of ethanol was followed by daily intragastric administration of 2.0 g/kg of ethanol. Pancreatic response to the same conditions was retested at 3 and 6 months. In the other method, under continuous perfusion of secretin and cholecystokinin a 1.3 g/kg ethanol infusion was given. Changes induced by chronic alcohol feeding on the plateau pancreatic secretory values were evaluated, with secretin alone or with secretin and cholecystokinin, at 6 weeks, and 3, 9, and 12 months. Pancreatic juice determinations in-

cluded flow rate, and the outputs and concentrations of bicarbonate, pretein, and lipase. Acute i.v. ethanol inhibited all constituents of exocrine pancreatic juice during the non-alcoholic stage in both experiments, but more markedly with secretin alone than when it was combined with cholecystokinin. The effects were greater on protein and lipase than the alkaline components; secretin alone resulting in a fall of bicarbonate output of 42.2% 40 min after ethanol injection while protein and lipase fell 73.5% and 61.2%, resp. Secretin and cholecystokinin resulted in a fall of bicarbonate output to 21.6% after 60 min, while protein and lipase 27.0% and 33.0%, resp. After 3 months ethanol injection no longer caused any significant inhibition. After 12 months, the effects were reversed, and almost all parameters showed significant increases. Chronic alcohol feeding with secretin alone caused an increase in bicarbonate concentration after 3 months. By 12 months, concentration and output of protein and lipase were significantly depressed. With secretin and cholecystokinin, at 6 weeks, 3, 9, and 12 months, volume and bicarbonate output were higher than during the non-alcoholic period. Protein values rose and after 12 months dropped to pre-treatment values. Lipase values also diminished after 12 months. It is concluded that chronic alcohol feeding as opposed to acute causes an inversion of exocrine pancreatic response and modifies plateau levels of secretion in response to secretin to cholecystokinin.

2571 SUBCUTANEOUS SECRETIN IN DOGS: INFLUENCE OF SOLVENT AND VOLUME OF SOLVENT. *(E.)* Verine, H. J.; Grossman, M. I. (VA Wadsworth Hosp. Cent., Los Angeles, Calif.). *Acta Hepatogastroenterol.* (Stuttg.) 22(1):35-40, 1974.

The effects of the solvents carboxymethylcellulose and gelatin on the magnitude and duration of action of s.c. secretin were tested. Three dogs were given a Thomas cannula and a pancreatic fistula at least a month before the experiment. The dogs were fasted for 18 hr, and 5.6 or 2.8 U/kg secretin were injected s.c. under the loose skin of the neck at one of three sites (2 ml/site). The secretin was dissolved in either 0.001 M HCl-saline, 16% gelatin, or 10% carboxymethylcellulose. Each of the 12 combinations of doses, solvents, and volumes of solvent were tested on separate days, one time in each of the three dogs. During each test the dogs received a continuous i.v. saline infusion (24 ml/hr). The volume of pancreatic juice was recorded every 10 min, and bicarbonate concentration was determined by titration. Peak output was not significantly related to the dose, solvent or solvent volume, but the time at which peak output occurred was related to dose and solvent. The peak occurred at 56 min with the 75 U dose, and at 74 min with the 150 U dose; and occurred at the earliest with saline and at the latest with gelatin. Duration of secretion at over 75% of peak was for 20-30 min with saline, but lasted for 90 min with gelatin or carbomethylcellulose. This was dependent on dose (49% greater with 150 U than with 75) and on solvent (84% greater with gelatin and 29% greater with carboxymethylcellulose than with saline). Duration of total response was 25% longer with the higher dose; 84% longer with gelatin and 36% longer with carboxymethylcellulose than with saline; and 27% longer with 6 ml than with 2 ml. Total bicarbonate output was 38% greater with the higher dose, 38% greater with gelatin and 10% greater with carboxymethylcellulose than saline, and 17% greater with the larger volume. It is concluded that carboxymethylcellulose, and to a greater extent gelatin, greatly enhance the magnitude and length of response to s.c. secretin.

2572 ELECTROPHORETIC CHARACTERIZATION OF PORCINE PANCREATIC (PRO)ELASTASES A AND B. *(E.)* Ledoux, M.; Lamy, F. (Fac. Med., Univ. Sherbrooke, Canada). *Can. J. Biochem.* 53(4):421-432, 1975.

Two porcine pancreatic zymogens (proelastases A and B) and the products of their activation by trypsin were characterized by polyacrylamide-gel electrophoresis, and the effect of these proelastases and trypsin on elastin was studied. The proelastases were purified and separated by free electrophoresis on a sucrose gradient. After activation by trypsin, both enzymes were able to completely hydrolyze elastin. Proelastase B, but not A, also had an esterolytic activity towards *N*-acetyl-L-tyrosine ethyl ester. To further identify the products of activation of proelastases A and B, the products were tagged with radioactive diisopropylfluorophosphonate and separated by polyacrylamide-gel electrophoresis. Proelastase A gave only one active species, pancreatopeptidase E, but three distinct proteins were obtained from proelastase B; one of the products of activation of B had the same mobility as its precursor. Elastases A and B exhibited a synergism when acting together on an elastin preparation from which the microfibrils were removed; a smaller degree of synergism was noted when an alkaline-treated elastin was used as substrate, and there was only a slight synergism when a commercial elastin preparation was used. There was little additional synergism when trypsin was added to mixtures of A and B, and there was no synergism noted when chymotrypsin was added to mixtures of A and B. The results indicate that although elastase B resembles α-chymotrypsin, it is a different enzyme; similarly, it is unlikely that proelastase B is the same as chymotrypsinogen B or C.

2573 PANCREATIC DUCT ABRASION AND SELECTIVE ASPIRATION OF SECRETION — EXPERIMENTS IN DOGS. *(E.)* Weidenhiller, S.; Stolte, M.; Koch, H.; Schwamberger, K.; Flugel, H. (Dep. Med., Univ. Erlangen-Nuremberg, Erlangen, Germany). *Endoscopy* 7 (1):10-17, 1975.

A method of abrading the pancreatic duct to obtain fresh cellular material for diagnosis is presented. Nine dogs were laparotomized and the duodenum opened. A size three Fogarty catheter was inserted into

the main pancreatic duct as far as possible. After injection of 2 IU/kg secretin, and pancreatic secretion through the papilla, the balloon of the catheter was partially expanded and drawn through a short section of duct several times. In three dogs the stimulated secretion was aspirated with the abraded material by means of a 20 ml syringe through a Teflon tube covering the catheter, and was centrifuged and stained. In all dogs, the balloon was inflated and drawn through the entire length of the duct several times. The air pressure was adjusted in different cases to vary the strength of abrasiveness from gentle to aggressive. The balloon was deflated, withdrawn, and rolled on glass slides which were subsequently treated with Pappenheim's stain. Four dogs were sacrificed immediately, one at four days, one at seven days, and three dogs at three weeks, and the pancreatic duct fixed, stained and examined by light microscopy. Intubation of the duct and aspiration of secretion was successful in all cases. In both aspirate and smear preparations, large numbers of connected duct epithelial cells as well as individual cells were obtained. Macroscopically, none of the ducts showed any pathological changes. Microscopically, the ducts of the dogs sacrificed immediately showed the layer of columnar epithelium had been almost completely abraded, but the continuity of the basement membrane was intact. Four days after the abrasion, the duct was lined completely with narrow cylindrical cells, easy to differentiate, and with occasional fine gaps between them. After seven days the cells were further matured and more compactly united. Of two dogs given gentle abrasion, one after three weeks showed incomplete layering of the regenerated epithelium, fine gaps, and multiple broad defects between cells, but in the other the duct epithelium was completely regenerated and intact. Another dog, three weeks after aggressive abrasion, showed epithelium almost indistinguishable from normal. It is concluded that good cytological material for diagnosis can be obtained successfully by this method of duct abrasion, and that the epithelium will be regenerated within three weeks.

2574 EXPERIMENTAL CONTRIBUTION TO THE STUDY OF PANCREATIC POLYSERITIS. TRANSDIAPHRAGMATIC AND LYMPHATIC DIFFUSION OF TRYPSIN. *(Fr.)* Warter, J.; Storck, D.; Warter, A. (Univ. Hosp. Cent., Strasbourg, France). *C. R. Soc. Biol. (Strasburg)* 108(6/7):860-865, 1974.

Intra- and retroperitoneal injections of trypsin alone, trypsin and Chinese ink, and Chinese ink in physiological solution were administered to rats (type unspecified) in order to determine the zones of passage of trypsin from the peritoneum into the pleural cavities. Both intra- and retroperitoneal injection of trypsin alone produced hemorrhagic overflow in the peritoneum and the pleura, with radial hemorrhage striation on both sides of the diaphragm but more intensely on the peritoneal side. There was intense vascular congestion in the subperitoneal space and on the intestinal chorion, cell lysis at the apex of the villi, edema, and subserosal hemorrhage. Such lesions are evidence of the direct transdiaphragmatic passage of trypsin injected into the peritoneum. Injection of trypsin with Chinese ink into the peritoneal cavity produced dyeing of the areas seen to be affected by injection of trysin alone. Also dyed were were the ganglia of the superior mediastinum; the fringes of the omentum; the Kupffer cells; the mesothelial cells of the peritoneum; the diaphragmatic, parietal, and visceral pleura; and the alveolar sacs in the lungs. This provides evidence of lymphatic and pleuro-pulmonary paths for resorption. Injection of trypsin and Chinese ink into the pleural cavity confirmed that trypsin does not pass from the pleura into the abdomen, although it is resorbed by a pleuro-pulmonary path. Injection of Chinese ink in physiological solution provides confirmation of the lymphatic resorption of trypsin and Chinese ink from both the peritoneal and pleural cavities.

2575 EFFECT OF A SOYBEAN DIET ON ENZYME CONTENT AND ULTRASTRUCTURE OF THE RAT EXOCRINE PANCREAS. *(E.)* Folsch, U. R.; Winckler, K.; Wormsley, K. G. (Dep. Med., Univ. Gottingen, Germany). *Digestion* 11(3/4):161-171, 1974.

The enzyme content and ultrastructure of exocrine pancreas was studied in rats fed raw soybean flour with active trypsin inhibitor, or heat-inactivated soybean flour. Two groups of five Wistar rats each were fed a diet containing either raw or heat-inactivated soybean flour for 20 days, while controls were fed a standard diet containing 42% carbohydrates, 19% protein, and 4% fat. After 20 days, all rats were killed following a 24 hr fast. Electron microscopic studies were done on pancreatic tissues from eight additional rats, given the same diets as above, but given in addition a 7.5 or 60 IU/kg/hr dose of cholecystokinin with a 0.5 CU/kg/hr dose of secretin for 4 hr before histological examination. The tissues were fixed in Karnowsky's solution, postfixed in 1% osmium tetroxide, and stained with toluidine blue for light microscopy, or uranyl acetate and lead citrate for electron microscopy. The pancreas was removed, weighed, homogenized, and analyzed for trypsin, amylase, lipase, and protein. The net weight of the pancreas/100 g body weight in the rats fed raw soybean flour was double that in those fed either heat-inactivated flour or standard diet. The latter two did not differ significantly. The raw flour-fed rats showed a significantly higher protein content (404 mg/pancreas), than standard diet-fed (161 mg) or heat-inactivated-fed rats. Amylase activity (4707 U/total pancreas) was significantly less in rats given the inactivated flour, than those given the standard diet (13,190 U) or given raw flour (11, 773). Activity of trypsin and lipase was significantly greater in inactivated flour-fed rats (19,403 and 5806, resp.) than standard diet-fed rats (9331 and 1642, resp.). Total pancreatic content of amylase and trypsin was greater in raw flour fed rats than inactivated flour-fed rats, but total lipase content did not vary significantly. Electron microscopy of tissues from rats not given exogenous hormones showed greatly increased numbers of zymogen granules in the acinar cells of the rats fed raw flour.

These were found in the basal as well as the apical parts of the cells. The rats on the other two diets showed no morphological changes. The rats on standard or inactivated diets showed a marked diminution in acinar cell zymogen granule content. The acinar cells of the raw flour-fed rats showed as many granules as non-hormone stimulated standard and inactivated-fed rats. It is concluded that raw soybean flour increases the total protein content by increasing enzyme and non-enzyme proteins; but except for an increase in the number of zymogen granules, cellular structures are not altered.

2576 ALCOHOL AND THE PANCREAS. *(E.)* Wheatley, I. C.; Waterworth, M. W.; Barbezat, G. O.; Bank, S.; Marks, S.; Hichman, R.; Terblanche, J. (Dep. Surg., Univ. Cape Town, South Africa). *S. Afr. J. Surg.* 12(4):202-203, 1974.

2577 ENTEROPANCREATIC CIRCULATION OF AN INTACT DIGESTIVE ENZYME. *(E.)* Liebow, C.; Rothman, S. S. (no affil.). *Fed. Proc.* 33(3):409, 1974.

2578 SYNTHETIC PEPTIDES SPANNING THE ENTIRE SEQUENCE OF PORCINE PANCREATIC SECRETORY TRYPSIN INHIBITOR II (KAZAL). *(E.)* Rocchi, R.; Benassi, C. A.; Guarneri, M.; Guggi, A.; Tomatis, R. (Inst. Pharm. Chem. Toxicol., Univ. Ferrara, Italy). *Int. J. Pept. Protein Res.* 6(6):391-395, 1974.

2579 CYCLIC AMP AND PANCREATIC BICARBONATE SECRETION IN DOGS. *(Ger.)* Domschke, S.; Konturek, S. J.; Domschke, W.; Demling, L. (Med. Clin., Univ. Erlangen-Nuremberg, Erlangen, Germany). *Z. Gastroenterol.* 12(Suppl.):421, 1974.

2580 STIMULATION OF THE EXOCRINE PANCREAS BY INTRADUODENALLY ADMINISTERED ALBUMIN AND AN ALBUMIN HYDROLYZATE IN HUMANS. *(Ger.)* Dollinger, H. C.; Goebell, H. (Cent. Intern. Med. Pediatr., Univ. Ulm, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:856-859, 1973.

2581 A PANCREATIC RIBONUCLEASE ACTIVE AT pH 4.5. *(E.)* Batholeyns, J.; Moore, S.; Stein, W. H. (Rockerfeller Univ., New York, N.Y.). *Int. J. Pept. Protein Res.* 6(6):407-417, 1974.

2582 NON-CONSTANT EVOLUTION RATES IN AMINO ACID SEQUENCES OF GUINEA PIG, CHINCHILLA AND COYPU PANCREATIC RIBONUCLEASES. *(E.)* van den Berg, A.; Beintema, J. J. (Biochem. Lab., Rijksuniv., Groningen, Netherlands). *Nature* 253(5488):207-210, 1975.

2583 EXOCRINE PANCREAS FUNCTION IN THE RAT: INHIBITION BY LARGE DOSES OF CCK-PANCREOZYMIN AND ANESTHESIA. *(Ger.)* Hotz, J.; Neumann, K.; Ziegler, R.; Goebell, H. (Dep. Intern. Med., Univ. Ulm, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:862-865, 1973.

2584 EXPERIENCES WITH A NEW TEST OF EXOCRINE PANCREATIC FUNCTION IN PROTEIN DEFICIENT PATAS MONKEYS. *(E.)* Gyr, K.; Wolf, R. H.; Imondi, A. R.; Felsenfeld, O. (Clin., Med. Univ. Basel, Switzerland). *Schweiz. Med. Wochenschr.* 104(50):1888-1889, 1974

2585 RESPONSE OF PANCREATIC SECRETION IN DOGS WITH CHRONIC ALCOHOLISM TO DOSES OF SECRETIN AND CHOLECYSTOKININ. *(Fr.)* Tiscornia, O. M.; Palasciano, G.; Sarles, H. (Res. Unit. Gastrointest. Dis., INSERM, Marseille, France). *Biol. Gastroenterol. (Paris)* 7(4):319-320, 1974.

2586 CHRONIC ALCOHOLISM AND THE GASTRIN PHASE OF EXOCRINE PANCREATIC SECRETION IN THE RAT. *(Fr.)* Cavarzan, A.; Teixeira, A. S.; Palasciano, G.; Dzieniszewski, J.; Tiscornia, O. M.; Sarles, H. (Res. Unit. Gastrointest. Dis., INSERM, Marseille, France). *Biol. Gastroenterol. (Paris)* 7(4):318, 1974.

2587 EFFECT OF THE CHRONIC ADMINISTRATION OF ALCOHOL ON THE ENZYME SYSTEMS WHICH METABOLIZE ETHANOL. *(Fr.)* Clemente, F.; Thouvenot, J. P.; Ribet, A. (Purpan Hosp., Toulouse, France). *Biol. Gastroenterol. (Paris)* 7(4):319, 1974.

2588 EFFECT OF ADRENERGIC AGENTS ON CIRCULATION AND BASAL AND STIMULATED PANCREATIC SECRETION IN THE DOG. *(Fr.)* Vaysse, N.; Pascal, J. P.; Fourtanier, G.; Roux, P.; Martinel, C.; Ribet, A. (Purpan Hosp., Toulouse, France). *Biol. Gastroenterol. (Paris)* 7(4):316, 1974.

2589 VARIATIONS IN THE INTRACELLULAR CONTENT OF CYCLIC AMP PRODUCED BY HORMONES PROMOTING PANCREATIC SECRETION IN THE RAT. *(Fr.)* Cailla, H. L.; Reggio, H.; Delaage, M.; Marchis-Mouren, G. (Cent. Biochem. Mol. Biol., CNRS, Marseille, France). *Biol. Gastroenterol. (Paris)* 7(4):317, 1974.

2590 FOOD-INDUCED CONTROL OF A SPECIFIC HORMONE SYSTEM IN THE DUODENAL MUCOSA WHICH REGULATES PANCREATIC SECRETION. *(Fr.)* Felber, J. P.; Zermatten, A.; Dick, J. (Canton. Hosp., Lausanne, Switzerland). *Biol. Gastroenterol. (Paris)* 7(4):321-322, 1974.

2591 THE SECRETION OF RECENTLY SYNTHESIZED PROTEINS BY THE HUMAN PANCREAS. *(Fr.)* Robberecht, P.; Cremer, M.; Deltenre, M.; Christophe, J. (Fac. Med., Free Univ., Brussels, Belgium). *Biol. Gastroenterol. (Paris)* 7(4):320, 1974.

2592 DOG PANCREATIC ARGININE ESTERASES, SPONTANEOUSLY ACTIVATED ON DEAE-SEPHADEX. *(E.)* Hojima, Y.; Yamashita, M.; Moriya, H. (Fac. Pharm. Sci., Univ. Tokyo, Japan). *Chem. Pharm. Bull.* 23(1):225-228, 1975.

2593 ENDOGENOUS PROTEIN KINASE IN THE MEMBRANE OF SECRETORY GRANULES IN THE PANCREAS. *(Fr.)* Lambert, M.; Camus, J.; Christophe, J. (Fac. Med., Free Univ., Brussels, Belgium). *Biol. Gastroenterol. (Paris)* 7(4):321, 1974.

2594 IDENTIFICATION OF ENZYMES IN HUMAN PANCREATIC JUICE ON POLYACRYLAMIDE GEL. *(Fr.)* de Caro, A.; Clemente, F.; Guy, O.; Figarella, C. (Res. Unit Gastrointest. Dis., INSERM, Marseille, France). *Biol. Gastroenterol. (Paris)* 7(4):318-319, 1974.

See also, 2404, 2534, 2812, 2816.

SECRETION AND METABOLISM

Hepatobiliary Tract

2595 DRUG INDUCTION OF HEPATIC GLUTATHIONE S-TRANSFERASES IN MALE AND FEMALE RATS. *(E.)* Kaplowitz, N.; Kuhlenkamp, J.; Clifton, G. (Nav. Reg. Med. Cent., Oakland, Calif.). *Biochem. J.* 146(2): 351-356, 1975.

The induction of the glutathione S-transferases by phenobarbital and polycyclic aromatic hydrocarbons was studied in male and female rats in order to examine similarities between these enzymes and ligandin, and also to identify a potentially inducible cytosolic enzyme system of importance in drug metabolism. Sprague-Dawley rats were given phenobarbital (2-8 mg in 0.9% NaCl) and 3,4-benzopyrene or 3-methyl-cholanthrene (1 mg in corn oil i.p. twice a day). The animals were killed 24 hr after the last dose; liver homogenates were prepared and centrifuged, then the supernatant fractions (cytosol) were collected for study. Administration of phenobarbital resulted in 60-80% increase in S-aryl and S-aralkyl enzyme specific activities, whereas the S-epoxide and S-alkyl activities were increased by 30-40%. In following the sequence of induction, the former 2 activities reached peak activities before an increase in the latter 2 activities was observed. Both 3-methylcholanthrene and 3,4-benzopyrene induced these 4 enzymic activities, but to a lesser degree than did phenobarbital (with the exception of S-epoxide activity). Significantly lower enzyme specific activities were found for 3 of the activities studied in female rats but no difference observed in S-alkyltransferase activity; however, the proportional increase in the enzymic activities in response to phenobarbital was the same in males and females. The findings demonstrate the inducibility of 4 glutathione S-transferase activities by phenobarbital and the 2 polycyclic aromatic hydrocarbons, and they further support the possibility that ligandin is part of the group of glutathione transferases.

2596 PROTECTION OF RATS AGAINST THE HEPATOTOXIC EFFECT OF PARACETAMOL. *(E.)* Gazzard, B. G.; Hughes, R. D.; Portmann, B.; Dordoni, B.; Williams, R. (King's Coll. Hosp. Med. Sch., London, England). *Br. J. Exp. Pathol.* 55(6):601-605, 1974.

The effectiveness of a number of agents against the hepatic damage caused by paracetamol was studied in rats. With the exception of the control group, all the animals received phenobarbitone (1 g/liter) in their drinking water and paracetemol (2.5 g/kg) *via* an intragastric tube immediately following the administration of the protective agents under study: i.v. glutathione (40 mg/kg); propranolol (40 mg/kg); thioctic acid (5 mg/kg); p.o. cysteamine (300 mg/kg); i.p. cysteamine (300 mg/kg); i.p. α-tocopherol acetate (400 mg/kg). Livers were removed 48 hr after administration of agents for histological assessment and determination of cytochrome P-450. The paracetamol-induced liver damage with corresponding reduction in levels of cytochrome P-450 was completely prevented by the oral cysteamine. The levels of cytochrome P-450 were maintained following i.p. α-tocopherol, but it had less effect on the histological evidence of liver damage. Glutathione, propranolol, and thioctic acid did not prevent liver damage, although the number of areas of necrosis (believed to be the result of infarction) was reduced except with glutathione. It was concluded that the degree of protection against liver damage afforded by the agents under study cannot be explained until the mode of action of the reactive metabolite of paracetamol is further understood.

2597 EFFECTS OF HYPOPHYSECTOMY OF LIVER DONOR ON NET SYNTHESIS OF SPECIFIC PLASMA PROTEINS BY THE ISOLATED PERFUSED RAT LIVER. MODULA-

TION OF SYNTHESIS OF ALBUMIN, FIBRINOGEN, α_1-ACID GLYCOPROTEIN, α_2-(ACUTE PHASE)-GLOBULIN, AND HAPTOGLOBIN BY INSULIN, CORTISOL, TRIIODOTHYRONINE, AND GROWTH HORMONE. *(E.)* Griffin, E. E.; Miller, L. L. (Univ. Rochester Sch. Med. Dent., N.Y.). *J. Biol. Chem.* 249(16):5062-5069, 1974.

The isolated adult male Sprague-Dawley rat liver perfused for 12 or 24 hr was used to study effects of total hypophysectomy of the liver donor, and of added cortisol, bovine growth hormone, insulin, and triiodothyronine on the net biosynthesis of 5 specific plasma proteins. Cortisol (5 mg) was added to the perfusion medium at the outset and by continuous infusion (a total of 10 mg) during the 24-hr period. Two of the other 3 hromones were added with the cortisol in the following quantities: insulin, 5 U initially and 13.6 U by infusion; growth hormone, 0.5 mg and 2 mg; and triiodothyronine, 2 µg and 4 µg. Plasma proteins released into the perfusion medium were measured by the single radial diffusion technique. With all 4 hormonal supplements, livers from fed hypophysectomized rats perfused at pH 7.10 synthesized about 50% less albumin than livers from normal donors while synthesis of fibrinogen, acid glycoprotein, and haptoglobin was close to that observed in normals. Fibrinogen synthesis in the absence of triiodothyronine was not different from that with the 4 hormones; however, deletion of either insulin or growth hormone resulted in a small but significant decrease in net synthesis below that seen with the 4 hormones. Deletion of either triiodothyronine, growth hormone, or insulin was associated with failure to increase synthesis of haptoglobin above that seen in the absence of all hormones at 12 hr, and at 24 hr was only 50% of that with all 4 hormones. In the absence of hormone supplements, synthesis of α_2-(acute phase)globulin by livers from hypophysectomized donors was undetectable. With all 4 hormones, synthesis of this protein was not significantly different from that by livers of normal donors. Omission of either triiodothyronine, insulin, or growth hormone diminished the net synthesis of the protein in a manner similar to that observed with haptoglobin. Omission of insulin or growth hormone caused a small but significant decrease in net uptake of free amino acid nitrogen. The absence of insulin was associated with increased urea production, negative nitrogen balance, and reduced incorporation of L-[1-^{14}C]leucine into hepatic protein. It is concluded that the regulation of the synthesis of several acute phase plasma proteins in livers from hypophysectomized rats is qualitatively and quantitatively as sensitive to the hormones tested as in livers from normal rats, the synthesis of α-acid glycoprotein being an exception because it is maximal in livers from hypophysectomized rats and is not further increased by hormones.

2598 COMPARATIVE STUDY OF THE ABSORPTION, ELIMINATION AND ACUTE HEPATOTOXIC ACTION OF ETHANOL IN GUINEA PIGS AND RATS. *(E.)* Strubelt, O.; Siegers, C. P.; Breining, H. (Med. Univ., Lubeck, Germany). *Arch. Toxicol. (Berl.)* 32(2):83-95, 1974.

The hepatotoxic effects and kinetics of ethanol were studied in male guinea pigs and Wistar rats. In fed guinea pigs, an oral dose of 6.4 g/kg of ethanol given as a 40% solution (v/v) produced a maximal blood alcohol level of 6.8 mg/ml, whereas in fed rats, blood alcohol levels after the same dose did not exceed 2.1 mg/ml. Maximal blood alcohol levels in fasted animals occurred 1-4 hr after an oral load of 4.8 g/kg of ethanol and were 6.3 mg/ml in guinea pigs and 3.7 mg/ml for rats. However, i.v. injected ethanol (1 g/kg) was eliminated at the same rate in both species (275 mg/kg/hr), and alcohol dehydrogenase activity of the liver related to body weight was 20% greater in guinea pigs than in rats. Therefore, absorption of ethanol occurred at a much slower rate in rats than in guinea pigs. This is possibly due to the fact that high ethanol concentrations strongly delay emptying of the rat stomach. Lowering the ethanol concentration accelerated absorption rate in the rat. However, even after gavage of a 10% solution, peak levels of blood alcohol were still lower by 36% in rats than in guinea pigs. In guinea pigs, increased activities of SGOT, SGPT, and glutamate dehydrogenase occurred after an oral dose of 4.8 g/kg or 6.4 g/kg of ethanol, resp. SGOT increased after 1.6 g/kg of ethanol p.o. After 6.4 g/kg of ethanol given to rats serum transaminase levels increased only slightly, and glutamate dehydrogenase activity not at all. Vacuolar degeneration was the morphological substrate of ethanol-induced liver damage in guinea pigs and rats. In guinea-pigs, it occurred after 1.6 g/kg of ethanol, whereas in rats only after 6.4 g/kg. It is concluded that the guinea pig is more suitable than the rat as a model for alcohol toxicity.

2599 DETERMINATION OF BILE ACID POOL SIZE IN MAN: A SIMPLIFIED METHOD WITH ADVANTAGES OF INCREASED PRECISION, SHORTENED ANALYSIS TIME, AND DECREASED ISOTOPE EXPOSURE. *(E.)* Duane, W. C.; Adler, R. D.; Bennion, L. J.; Ginsberg, R. L. (Phoenix Indian Med. Cent., Ariz.). *J. Lipid Res.* 16(2):155-158, 1975.

A simplified method is described for estimating the bile acid pool size in man. The procedure, studied in 26 healthy volunteers aged 19-34, involves either i.v. or intragastric infusion of 1-5 µCi ^{14}C- or 3-15 µCi ^{3}H-cholic acid 6 hr after a light supper. Contents from the descending duodenum are withdrawn by tube the next morning following stimulation of gallbladder contraction with protein hydrolysate. Total bile acid pool size (P_T) is calculated from total bile acid concentration (B_T), the radioactivity administered (dpm_A) and the concentration of radioactivity in the bile acids (dpm_T) according to the formula: $P_T = dpm_A (B_T/dpm_T)$. The precision of this method (±2.6%), which is not influenced by the route of administration of cholic acid nor by the type of radioactive label, compares favorably to that of the Lindstedt method (±7.9%). Other advantages over the Lindstedt method include the requirement for only one duodenal intubation and the necessity of using only 12.5-25% of the radionuclide dose. In 16 comparisons, pool size measured 13.7% higher by this method than by the Lindstedt procedure, a difference predicted by extrapolation of the cholic acid specific activity of the Lindstedt method to time zero.

2600 STUDIES ON UREA CYCLE ENZYMES IN RAT LIVER DURING ACUTE URAEMIA. *(E.)* Hoppe-Seyler, G.; Maier, K. P.; Schollmeyer, P.; Frohlich, J.; Talke, H.; Gerok, W. (Dep. Intern. Med., Univ. Freiburg, Germany). *Eur. J. Clin. Invest.* 5(1):15-20, 1975.

Urea cycle enzyme activities were measured in female albino Sprague-Dawley rats 12 and 48 hr after ligature of both renal pedicles. After 12 hr, ornithine carbamyl transferase specific activity of liver homogenates was elevated by 30% whereas, after 48 hr, specific activities of both this and argininosuccinic acid synthetase were increased by 55% and 33%, resp. Activities of argininosuccinic acid lyase, glutamic-aspartic-transaminase, glutamic-alanine-transaminase and ornithine-δ-amino-transferase were unaffected except for a 50% decrease after 48 hr in ornithine-δ-amino-transferase. Except for the decrease in ornithine-δ-amino-transferase, changes in activities of the other enzymes were not so marked as seen during prolonged starvation. Based on previous findings which failed to detect changes in liver ornithine concentration in the uremic state, it is concluded that the present results are not consistent with the concept that accelerated urea production in the liver of acutely uremic rats is due to increased liver ornithine concentration secondary to decreased ornithine-δ-amino-transferase activity.

2601 MULTIPLE HEPATIC EXCRETORY MECHANISMS FOR ORGANIC ANIONS. A STUDY WITH SUCCINYLSULFATHIAZOLE AND TAUROCHOLATE IN THE RAT. *(E.)* Bailey, D. G.; Johnson, G. E. (Dep. Pharmacol., Univ. Toronto, Canada). *Can. J. Physiol. Pharmacol.* 53(1): 97-103, 1975.

The interactions during biliary excretion of succinylsulfathiazole and taurocholate were studied in male Wistar rats. Following infusion of ^{14}C-succinylsulfathiazole (100 mg/kg) or ^{3}H-taurocholate (56 mg/kg) separately over a 3-5 min period, all of the taurocholate but only about 10% of the succinylsulfathiazole was excreted in the bile over 40 min. Concomitant administration of the 2 substances reduced the amounts of taurocholate and succinylsulfathiazole excreted into the bile to 81% and 8%, resp., after 40 min. Bile flow rate was increased about 1.5-fold following administration of either substance alone and about 3-fold when both were given together. Bile concentration of ^{3}H-taurocholate was significantly less (18.9 mg/g wet weight) in animals receiving both substances than in those receiving only taurocholate (28.0 mg/g). Bile succinylsulfathiazole concentration was similarly reduced in rats given taurocholate simultaneously. Concomitant administration of either substance did not affect the binding of the other to plasma proteins. These results are consistent with the presence of a single liver-to-bile transport system for the 2 substances although they are in contrast to previous reports which showed an increase in biliary excretion of acidic compounds in animals given taurocholate. It is thus suggested that more than one transport system for biliary excretion of organic anions may exist.

2602 EXPERIMENTS WITH 1-^{14}C-ACETATE ON THE LIPID METABOLISM OF HUMAN LIVER BIOPSIES AND THEIR DEPENDENCE UPON THE DIETARY FAT CONTENT. *(Ger.)* Oette, K.; Phlippen, R.; Lanckohr, H. (Med. Clin., Cologne Univ., Germany). *Res. Exp. Med. (Berl.)* 162(2):83-103, 1974.

The lipid metabolism from 1-^{14}C-acetate and esterification was studied in human liver biopsies from patients with diseases other than liver cirrhosis. The patients were kept on special diets for 6 days prior to biopsy. The fatty acid synthesis and the esterification patterns of synthetized fatty acids were inversely dependent on the fat-carbohydrate content of the diet. By increasing the dietary fat content, fatty acid neosynthesis ceased almost completely at 55 cal%. The remaining activity was believed to be mainly due to chain elongation products. The activity of the enzyme system for fatty acid neosynthesis decreased slowly within 3 to 6 days. Most of the radioactivity appeared in the long-chain fatty acids with chain lengths over 16 carbon atoms. Fatty acids with not more than 10 carbon atoms accounted for 12% of the total activity. The rate of radioactivity uptake in the liver lipids was highest in normal diet, and lowest at dietary fat contents of 0-5 cal% and 55 cal%. The relative cholesterol content was substantially higher following fat-rich diet than after low-fat diet. The fatty acids synthesized at dietary fat contents ranging from 0 to 40 cal% were distributed rather evenly among glycerides and phosphatides. Low rate of synthesis in chronic hepatitis under low-fat diet was observed. The rate of 1-^{14}C-acetate incorporation in the total lipids with extremely reduced uptake in the phosphatides was measured in a patient with alcohol-induced fatty liver. The findings indicate that the composition of the liver glycerides is essentially determined by the acylase activities, and that 1-^{14}C-acetate tests are suitable for the determination of the suppression of the fatty acid neosynthesis in high-fat diet, which is practically complete at 50 cal% fat, but not for the study of the fatty acid neosynthesis in low-fat diet due to isotope dilution.

2603 PRODUCTION OF THE FEATURES OF REYE'S SYNDROME IN RATS WITH 4-PENTENOIC ACID. *(E.)* Glasgow, A. M.; Chase, H. P. (Univ. Colorado Med. Cent., Denver). *Pediatr. Res.* 9(3):133-138, 1975.

Male Sprague-Dawley rats were injected with pentenoic acid in an attempt to reproduce the features of Reye's syndrome. All rats given a single i.p. injection of 200 mg/kg purified pentenoic acid died within 1 hr. Mean plasma ammonia levels were elevated about 4-fold in rats allowed free access to food and about 6-fold in 2 of the 20-hr fasted rats following 200 mg/kg pentenoic acid. Fasted rats also responded with hypoglycemia and 3 rats developed mild acidosis. Chronic administration of pentenoic acid (50 mg/kg every 4 hr x 10, then 200 mg/kg i.p. once) resulted in slight weight loss, elevation of SGOT and blood urea nitrogen and decreased free fatty acid levels but no change in blood glucose, Na^{+} or total bilirubin. Livers from treated rats showed extensive fatty degeneration but no evidence of necrosis, inflammation

or bile stasis. It is concluded that pentenoic acid, an analog of hypoglycin, produces findings similar to those of Reye's syndrome and to Jamaican vomiting sickness.

2604 INFLUENCE OF HYDROCORTISONE ON BLOOD CLOTTING AND FIBRINOLYSIS AFTER A STANDARD RESECTION OF THE LIVER IN DOGS. *(E.)* Hafstrom, L.; Lede, R.; Stehlin, J. S.; Brown, R. O. (St. Joseph Hosp., Houston, Tex.). *Surg. Gynecol. Obstet.* 139 (6):860-866, 1974.

Standard liver resection was carried out on 19 mongrel dogs. A group of 7 dogs was treated with hydrocortisone, 50 mg given before operation, 50 mg after, and 50 mg i.m. daily for 4 days. Another group of 7 dogs was given no hydrocortisone. A group of 5 dogs was also treated with hydrocortisone, 200 mg before and after the surgical procedure and 200 mg i.m. daily for 4 days after the operation. Three dogs were subjected to a sham procedure. Blood samples were taken before and after resection, and used for the tests on blood coagulation and fibrinolysis. There was no difference in blood clotting and fibrinolysis between the group treated with 50 mg hydrocortisone and the untreated group. Of the 14 dogs in these 2 groups, 6 had a prolonged activated partial thromboplastin time on the day of resection and 2 the day after the resection. On the other hand, none of the 5 dogs given 200 mg hydrocortisone had a prolonged activated partial thromboplastin time. The causes of the prolonged activated partial thromboplastin time after hepatic resection were decreased synthesis, increased fibrinolysis without consumption, release of anticoagulative factors, and local or general intravascular coagulation. Evidence of inhibitory substances was found in 3 dogs. There was no effect of hydrocortisone on the post-operative mortality rate after liver resection. These results suggest that large doses of hydrocortisone before and after resection can prevent a prolongation of activated partial thromboplastin time after resection but the possible negative effects of hydrocortisone on the regenerative process and on metabolism should be considered.

2605 RAPID TRANSESTERIFICATION OF BILIRUBIN GLUCURONIDES IN METHANOL. *(E.)* Salmon, M.; Fenselau, C.; Cukier, J. O.; Odell, G. B. (Johns Hopkins Univ. Sch. Med., Baltimore, Md.). *Life Sci.* 15(12):2069-2078, 1974.

The rapid transesterification of bilirubin conjugates exposed to methanol was studied. Rat bile, washed with hexane and chloroform and lyophilized, was separated on thin layer chromatography into two major components. Glucuronic acid and bilirubin were present in the faster moving spot in a molar ratio of 0.96:1, and in the slower in a 2.01:1 ratio. Conversion of the slow running spot to sulfanilyazo derivatives yielded one class of derivatives on cellulose and silica gel plates suggesting that the two halves of the bilirubin molecule are identically conjugated. The faster spot was converted to two classes of sulfanilylazo derivatives separable by thin layer chromatography, suggesting that only half of the tetrapyrrole is conjugated. Based on these and further analyses, the two major components of the washed bile were identified as the mono- and diglucuronide conjugates of bilirubin. Characterization of the transesterification products formed after solution in methanol for 2 hr revealed dimethyl and monomethyl bilirubin. The conjugates of bilirubin and their methyl esters were isolated by thin layer chromatography and the isolates were chemically quantitated for their bilirubin and glucuronic acid composition. Characterization of the bilirubin methyl esters was performed by mass spectrometric analysis of the trimethylsilyl and phenylazo derivatives. Additional confirmation of the assignment of the dimethyl diester structure to the major product of transesterification by methanol was obtained by comparison to the authentic dimethyl diester of bilirubin. Ultraviolet absorption curves were identical and mass spectra were similar with very small molecular ion peaks at m/e 612 and major peaks at m/e 227, 241, 300, and 313. These results are significant in understanding hepatic excretion of bilirubin. Solvent partitioning of polar conjugates of bilirubin in bile have frequently employed methanol and chloroform. Because of the *in vitro* capacity of glucuronides of bilirubin to undergo transesterification in methanol, the resulting methyl esters would be preferentially recovered in the apolar chloroform layer. Subsequent chemical analysis by diazo reaction would lead to both a qualitatively and quantitatively erroneous interpretation of the excretion of unconjugated bilirubin in bile, as the methyl esters of bilirubin have the same reaction requirements as unconjugated bilirubin with diazotized sulfanilic acid, ethyl anthranilate and phenyl diazonium chloride. Such transesterification may contribute to differences noted by workers in the amounts of free, mono-, and diglucuronides of bilirubin recovered in bile. This reaction offers an alternative to transamination for the characterization of conjugates of bilirubin.

2606 KINETIC PROPERTIES OF BABOON LIVER ALKALINE PHOSPHATASE. *(E.)* Balinsky, D.; Hammond, K. D.; Bershon, I.; Jersky, J. (South African Inst. Med. Res., Johannesburg). *S. Afr. J. Sci.* 70(2):61-62, 1974.

The kinetic properties of alkaline phosphatase purified from the livers of baboons were studied following auxiliary liver transplant. Michaelis constants for p-nitro-phenylphosphate at pH 9.0 and 10.2 and for phenolphthalein monophosphate at pH 9.9 were 0.044, 0.44 and 2.71 mM, resp. Enzyme activity was inhibited by ethylenediaminetetraacetic acid, L-cysteine and L-histidine and was stimulated by Mg^{++} ions. In addition, several other amino acids exhibited uncompetitive inhibition possibly by inhibiting breakdown of the phosphoryl-enzyme complex. Isoelectric focusing in polyacrylamide gels showed an isoelectric point of pH 4.3-4.6. The enzyme showed 50% inactivation at 58 C after 32 min. These properties were similar to those of human alkaline phosphatase with the exception of thermostability and isoelectric point.

2607 ACETAMINOPHEN-INDUCED HEPATIC NECROSIS. V. CORRELATION OF HEPATIC NECROSIS, COVALENT BINDING AND GLUTATHIONE DEPLETION IN HAMSTERS. *(E.)* Potter, W. Z.; Thorgeirsson, S. S.; Jollow, D. J.; Mitchell, J. R. (Lab. Chem. Pharmacol., Natl. Inst. Health, Bethesda, Md.). *Pharmacology* 12(3): 129-143, 1974.

The relationships between hepatic glutathione depletion, arylation of hepatic macromolecules *in vivo* and *in vitro* and hepatic necrosis were studied after administration of acetaminophen to hamsters. Animals treated with 3-methylcholanthrene (40 mg/kg i.p.) for 3 days followed by acetaminophen (150-300 mg/kg) 24 hr later showed an increase in incidence and severity of liver necrosis. Treatment with phenobarbital (75 mg/kg), piperonyl butoxide (0.8 ml/kg), and cobaltous chloride (50 mg/kg) followed by acetaminophen (300-425 mg/kg) caused a decrease in incidence and severity of liver necrosis. Diethyl maleate (0.4 ml) was administered to deplete endogenous hepatic glutathione followed 30 min later with acetaminophen (200-425 mg/kg); both the severity of necrosis and mortality rate increased. None of the pretreatments appeared to alter absorption of acetaminophen, but piperonyl butoxide decreased its rate of disappearance in plasma, phenobarbital increased its rate of disappearance, and 3-methylcholanthrene had little effect on its plasma concentration. When ^{3}H-acetaminophen (300 mg/kg) was used, the amount of covalently bound metabolites of acetaminophen found in the liver paralleled the severity of the liver necrosis. Covalent binding of radiolabel to hamster microsomes was dependent on NADPH and O_2 and inhibited by a specific antibody against purified NADPH cytochrome c reductase. In hamsters pretreated with 3-methylcholanthrene, hepatic concentration of glutathione was depleted to 10% of normal 75 min after acetominophen. Piperonyl butoxide markedly decreased and phenobarbital moderately decreased the glutathione depletion. The results support the hypothesis that acetaminophen-induced hepatic necrosis results from the metabolic activation of the drug to an arylating metabolite by cytochrome P-450 oxidases in the liver.

2608 EFFECT OF COLCHICINE ON COLLAGEN, ALBUMIN AND TRANSFERRIN SYNTHESIS BY CIRRHOTIC RAT LIVER SLICES. *(E.)* Rojkind, M.; Kershenobich, D. (Cent. Invest. Adv. Stud., Natl. Polytech. Inst., Mexico City, Mexico). *Biochim. Biophys. Acta* 378(3): 415-523, 1975.

The effect of colchicine and L-azetidine-2-carboxylic acid on liver function and collagen synthesis was studied in rats made cirrhotic by the chronic administration of CCl_4 (0.15 ml i.p. 3/week, 20 injections). The control group of rats was killed 24-48 hr after the last dose of CCl_4; the second group kept 30 days without further treatment; the third group treated with colchicine (10 µg/day intragastrically 5/week, 20 injections); the fourth group was treated with 10 µM L-azetidine-2-carboxylic acip p.o. every other day for 12 doses. Histological examinations of the liver were made and the *in vitro* incorporation of ^{14}C-labeled proline into collagen and non-collagenous proteins was analyzed, and its incorporation into albumin and transferrin. Liver function in rats receiving CCl_4 was impaired as evidenced by high values of serum albumin; incorporation of radioactive proline into collagen hydroxyproline was greatly enhanced. In animals treated with colchicine, a 50% inhibition in proline incorporation into collagen hydroxyproline was observed and the amount of conjugated bilirubin was 0.49 mg/100 ml. Transferrin biosynthesis remained constant in both cirrhotic and colchicine liver slices. Rats treated with L-azetidine-2-carboxylic acid during the 30-day period following CCl_4 showed a slight but not significant improvement in liver function; collagen synthesis and extent of fibrosis were similar to controls. The results show that the administration of colchicine to cirrhotic animals was accompanied by an improvement in liver function; thus, colchicine may be clinically useful in treating human patients with liver cirrhosis.

2609 TRANSIENT LIQUID CRYSTALS IN HUMAN BILE ANALOGUES. *(E.)* Holzbach, R. T.; Marsh, M. (Cleveland Clin. Found., Ohio). *Mol. Cryst. Liquid Cryst.* 28(2):217-222, 1974.

The process of phase transition and equilibration was studied by phase separation microscopy in 30 bile analog systems differing in relative lecithin:bile salt concentrations. Although not observed in the systems in which lecithin concentration was less than 14%, those with lecithin concentrations between 14-30 M% developed a liquid crystalline mesophase which gradually developed into cholesterol microcrystallites. The transition times for development of the cholesterol crystals were a function of the lecithin concentration, ranging from 7 days for 14-18 M% to 21 days for 22-30 M%. Solutions containing lecithin from 35-65 M%, concentrations which exceed that allowing for maximum cholesterol solubility, remained turbid due to a persistent mesophase. Fresh human bile specimens from patients with gallstones, which contained more cholesterol crystals than specimens from normal subjects, underwent spontaneous transition phenomena identical to those seen in the compositionally similar bile analog solutions. It is concluded that a transient crystalline mesophase observed in human bile is seen in physiologically relevant lipid concentrations.

2610 EFFECT OF BILIARY STASIS AND HEPATOTOXINS ON THE EXCRETION OF IOPANOATE IN THE RAT. *(E.)* Cooke, W. J.; Berndt, W. O.; Mudge, G. H. (Dartmouth Med. Sch., Hanover, N.H.). *J. Pharmacol. Exp. Ther.* 192(3):618-629, 1975.

The renal and biliary excretion of the cholecystographic compound iopanoic acid was analyzed in male Sprague-Dawley rats in the presence of hepatic dysfunction induced with several agents and after biliary obstruction produced surgically. Hepatic dysfunction was induced with CCl (1 or 2 mg in corn oil p.o., 18 or 20 hr prior to the experiment, SKF 525-A (25 mg/kg i.v. 30 min prior to iopanoate administration),

taurolithocholic acid (5 mg/ml in 0.15 M NaCl containing 10% bovine serum albumin in an infusion started 30 min before and completed 15 min after iopanoate injection, and d-napthyliosthiocyanate (100 mg/kg in 1.5% carboxymethylcellulose p.o. 18 or 20 hr prior to the experiment) and by acute and chronic surgical ligation of the bile duct. Biliary and urinary excretion of ^{125}I-labeled iopanoate was measured after a total dose of iopanoate of 5 mg/kg was given i.v. over a 2-min period. In the absence of normal biliary excretion, the amount of iopanoate excreted in the urine varied from 0.25-11.2% of the dose, with highest rates of urinary excretion occurring after α-naphthylisothiocyanate and chronic stasis. Drug disposition was further determined by tissue analysis of liver and kidney. The results indicate that, for a drug that is normally almost exclusively excreted by the bile, in the presence of hepatic dysfunction the amount excreted by the alternate route depends on the type of the induced hepatic disorder. It is concluded that the intrarenal distribution of ^{125}I-radioactivity is strongly influenced by its plasma concentration rather than just by the rate of excretion in the urine.

2611 BIOSYNTHESIS OF BILE ACIDS IN MAN. HYDROXYLATION OF THE C_{27}-STEROID SIDE CHAIN. *(E.)* Bjorkhem, I.; Gustafsson, J.; Johansson, G.; Persson, B. (Dep. Chem., Karolinska Inst., Stockholm, Sweden). *J. Clin. Invest.* 55:478-486, 1975.

The mechanisms of side chain degradation in the biosynthesis of bile acids in man were studied by analyzing hydroxylations of the side chain of different C_{27}-steroids catalyzed by the mitochondrial and microsomal fractions of liver homogenates from 14 patients with various disease (cholelithiasis, 1; carcinoma of the pancreas, 1; carcinoma of the stomach, 2; chronic myelocytic leukemia, 2; Hodgkin's disease, 2; agranulocytosis, 1; hereditary spherocytosis, 1; pheochromocytoma, 1; lymphosarcoma, 1; intoxication with tricyclic antidepressants, 1; and head injury, 1). Liver tissues were homogenized within 5-30 min after excision of the sample. The microsomal fraction was obtained from the homogenate by centrifugation at 800 g, 20,000 g and 100,000 g. The microsomal pellet was resuspended in the homogenizing medium and homogenized before incubation. The mitochondrial fraction was obtained by resuspension in 0.25 M sucrose of the pellet obtained after centrifugation at 20,000 g and recentrifugation at 8500 g for 12 min. In standard incubations with the microsomal fractions, 250 μg of the steroid, dissolved in 50 μl of acetone, was incubated with 1.5 ml of the microsomal fraction in a total volume of 3 ml of the homogenizing medium. In standard incubations with the mitochondrial fraction, 100 μg of the steroid dissolved in 50 μl of acetone was incubated with 1.0 ml of the mitochondrial fraction in a total volume of 3 ml of the homogenizing medium. Incubations were performed at 37 C for 20 min and were terminated by the addition of 20 vol of chloroform-methanol. The chloroform extract was evaporated and subjected to thin-layer chromatography. The microsomal fraction catalyzed an efficient 25-hydroxylation of 5 β-cholestane-3α, 7α, 12α-triol. A small extent of 23-, 24-, and 26-hydroxylation of the same substrate was observed. 5 β-cholestane-3α, 7α-diol was hydroxylated in the 25-position only to a very small extent. The mitochondrial fraction catalyzed 26-hydroxylation of cholesterol, 5-cholestene-3β, 7α-diol, 5β-cholestane-3α, 7α-diol, 7α-hydroxy-4-cholesten-3-one, and 5β-cholestane-3α,7α,12α-triol. Addition of Mg^{++} stimulated the 26-hydroxylation of cholesterol but had no effect or an inhibitory effect on 26-hydroxylation of the other substrates, indicating a heterogeneity of the mitochondrial 26-hydroxylating system. The level of 26-hydroxylase activity towards different substrates varied considerably with different mitochondrial preparations. The results indicate that microsomal 26-hydroxylation is less important than mitochondrial 26-hydroxylation under normal conditions; the possibility that microsomal 25-hydroxylation is important cannot be ruled out.

2612 ACETAMINOPHEN-INDUCED HEPATIC NECROSIS. VI. METABOLIC DISPOSITION OF TOXIC AND NONTOXIC DOSES OF ACETAMINOPHEN. *(E.)* Jollow, D. J.; Thorgiersson, S. S.; Potter, W. Z.; Hashimoto, M.; Mitchell, J. R. (Natl. Heart Lung Inst., Bethesda, Md.). *Pharmacology* 12(4/5):251-271, 1974.

The relation between the metabolic disposition of acetaminophen and the susceptibility of male golden Syrian hamsters, male GP mice, and male Sprague-Dawley rats to acetaminophen-induced liver necrosis was examined. Animals were allowed food and water *ad libitum*. Some were treated daily with i.p. doses of phenobarbital (80 mg/kg for 3 days) or 3-methylcholanthrene (20 mg/kg for 2 days). Other animals received piperonyl butoxide (hamsters, 800 mg/kg, mice 1360 mg/kg, and rats 800 mg/kg) i.p. 30 min before acetaminophen. Animals received various doses of acetaminophen (25-1200 mg/kg i.p.) dissolved in 0.9% saline solution. ^{3}H-acetaminophen was added to the dose so that each animal received 100 μCi/kg. Metabolites of acetaminophen excreted in the urine were separated by thin layer chromatography and identified by mass spectrometry. The fraction of low doses of acetaminophen converted to the mercapturic acid metabolite was highest in the most susceptible species (hamster, mice) and lowest in the more resistant species (rat). Pretreatment regimens known to potentiate the hepatotoxicity of acetaminophen increased mercapturic acid formation whereas treatments which protect from liver damage decreased mercapturic acid formation. The data suggest that the activity of the mercapturic acid-forming pathway *in vivo* reflects the activity of the hepatotoxic pathway. As the dose of acetominophen was increased to hepatotoxic levels, the fraction of the dose excreted as the mercapturic acid decreased markedly, commensurate with the known depletion of hepatic glutathione under these conditions. It is suggested that the normal metabolic intermediate which conjugates with glutathione in the mercapturic acid pathway is also the electrophilic metabolite which in the absence of glutathione arylates hepatic macromolecules and causes cell death.

2613 EFFECTS OF CHRONIC INGESTION OF SOME LOWER ALIPHATIC ALCOHOLS IN RATS. *(E.)* Hillblom, M. E.; Franssila, K.; Forsander, O. A. (Res. Lab. State Alcohol Monop., Helsinki, Finland). *Res. Commun. Chem. Pathol. Pharmacol.* 9(1):177-180, 1974.

The possibility that n-propanol or isobutanol may be more toxic than ethanol was tested by giving diluted (1 M) solutions of ethanol, n-propanol, or isobutanol to 4-month old male Wistar rats for their sole drinking fluid for 4 months. Ordinary laboratory chow containing about 26% of the calories as protein, 55% as carbohydrate, and 19% as fat was provided *ad libitum*. At the end of the test period the animals were decapitated and their livers weighed. Formalin-fixed liver secretions were stained with hematoxylin and eosin, toluidine blue, the periodic acid Schiff reaction with and without diastase, and Weigert-van Gieson, and evaluated under a light microscope. The amounts of ethanol and n-propanol consumed remained almost constant from beginning to end of the experiment, but the consumption of isobutanol increased significantly. A lower ratio of weight gain to caloric intake was seen in the rats given n-propanol indicating that this group utilized food less efficiently than the ethanol-treated group. The mechanism by which n-propanol interferes with food utilization is unknown. Rats treated with isobutanol had enlarged gas- and/or food-filled stomachs, and some animals had signs of small intestinal bleeding and constipation. Since the increase in isobutanol consumption was accompanied by slight increases in total caloric and fluid intakes, it is speculated that isobutanol somehow disturbed food absorption from the gastrointestinal tract. The absence of liver abnormalities in the ethanol-treated animals is attributed to the fact that the amount of ethanol consumed was not enough to produce fatty, cirrhotic, or fibrotic lesions in the liver. It is suggested that n-propanol and isobutanol are not more harmful to the rat liver than ethanol when administered p.o. for periods of several weeks to several months. The daily doses of congeners in this animal experiment greatly exceeded those generally consumed in hard liquors and wine by heavy drinkers. The duration of exposure, however, was much shorter. No extrapolation, therefore, to the situation in man can be made and the relative hepatotoxicity of the main congeners as compared to ethanol in humans remains unresolved.

2614 INFLUENCE OF PRIMARY BILE ACID FEEDING ON CHOLESTEROL METABOLISM AND HEPATIC FUNCTION IN THE RHESUS MONKEY. *(E.)* Webster, K. H.; Lancaster, M. C.; Hofmann, A. F.; Wease, D. F.; Baggenstoss, A. H. (VA Hosp., Alburquerque, N.M.). *Mayo Clin. Proc.* 50(3):134-138, 1975.

Studies were performed to define the effect of feeding cholic acid or chenodeoxycholic acid (in doses similar to those used for gallstone therapy in man) on cholesterol metabolism, liver function, and liver morphology in the rhesus monkey. After a 5-week equilibration period, 4 of 10 monkeys were killed for bile collection and the remaining 6 used for the metabolic study. Labeled cholesterol was given i.v., and cholesterol pool size and turnover rates were determined by an isotope dilution technique for the 10-week study period. After these initial studies, 3 animals received chenodeoxycholic acid p.o. (both 20 mg/kg/day) for an additional 15 weeks. In the monkeys fed chenodeoxycholic acid, there was no consistent increase in the total exchangeable cholesterol pool or input to the cholesterol pool. In the 3 monkeys fed cholic acid, the total exchangeable pool increased in all animals and input to the cholesterol pool increased in 2. SGPT increased transiently in 2 animals in each group. Morphologic abnormalities (triaditis with atypical ductular proliferation) were noted in 1 animal; this animal was ingesting chenodeoxycholic acid but had normal liver test results at the time of biopsy. Biliary bile acids contained 8-14% lithocholic acid in the chenodeoxycholic acid group and 48-72% deoxycholic acid in the cholic acid group. The present study is the third to show that chenodeoxycholic acid administration does not expand the exchangeable cholesterol pool or increase serum cholesterol levels in primates, including man. During bile acid feeding, the ratio of secondary to primary bile acids is greater in the rhesus monkey than in gallstone patients. The reason for the increased proportion of secondary bile acid is unknown. The simplest explanation is that increased input of 7 α-dehydroxylated bile acids occurs in the monkey, presumably in the cecum. It is also possible that intestinal conservation may be more efficient in the monkey. Chenodeoxycholic acid appears to be less hepatotoxic in man than in the rhesus monkey. Whether the hepatotoxicity is caused by increased lithocholate input of altered lithocholate disposition is unclear. It is also not clear whether these findings are invariably true in the rhesus monkey or merely reflect an abnormality in the intestinal flora of the 3 animals used in this study.

2615 ASPECTS OF BILE SECRETION IN THE RABBIT. *(E.)* Rutishauser, S. C. B.; Stone, S. L. (Dep. Physiol., Univ. Coll., Cardiff, Wales). *J. Physiol. (Lond.)* 245(3):567-582, 1975.

The effects of a dihydroxy and a trihydroxy bile salt were compared in anesthetized rabbits in which hepatic bile was collected by cannulation of the common bile duct. The animals were anesthetized either with pentobarbitone (30 mg/kg in 0.9% NaCl injected into an ear vein) or with urethane (5 ml/kg of a 25% solution i.p.). Bile flow in the group anesthetized with urethane was significantly lower than that in the group anesthetized with pentobarbitone sodium. The concentration of bile salt in bile was significantly higher in the urethane group; this was associated with a higher biliary osmolality. I.p. injection of a hypertonic solution of sucrose (3 M) decreased bile flow and produced changes in the ionic composition of bile and of plasma. The biliary concentrations of sodium, potassium and bicarbonate all increased despite the fact that the plasma concentrations of these ions declined. The infusion of sodium taurodeoxycholate (1.5 - 20 μM/min i.v.) gave higher rates of bile flow than did equimolar infusions of sodium taurocholate, and unlike taurocholate, increased the bicarbonate

concentration of bile. The choleretic efficiency of taurodeoxycholate decreased from about 50 ml/mM at an infusion rate of 20 nm/min/g liver to about 15 ml/mM at an infusion rate of 200 nM/min/g liver. On no occasion did the infusion of bile salt increase the osmolality of bile or of plasma. Both taurodeoxycholate and taurocholate increased the concentrations of sodium and bile salt in bile, and decreased the concentration of chloride. Taurodeoxycholate consistently increased the concentration of bicarbonate in bile, whereas taurocholate caused a net decrease in concentration. Acetazolamide (10-100 mg/kg) increased the concentration of bicarbonate both in bile and in plasma, and had little effect on bile flow. The infusion of BSP (5 mg/kg i.v.) decreased the excretion of bicarbonate into bile, and was associated with the formation of a hypotonic bile. It is concluded that the three anions studied, taurodeoxycholate, taurocholate, and BSP, differ in the effects that they have on the flow and composition of bile. If the anions differ in this way, then the factors limiting their secretion into bile may not be simply the availability of carrier site at the biliary membrane, but may be the prevailing conditions within the canaliculus itself.

2616 THE CHOLERETIC EFFECT OF IODIPAMIDE. *(E.)* Feld, G. K.; Loeb, P. M.; Berk, R. N.; Wheeler, H. O. (Univ. California, San Diego, Sch. Med., La Jolla). *J. Clin. Invest.* 55:528-535, 1975.

Experiments were performed in 3 trained, unanesthetized dogs (prepared several months earlier by cholecystectomy and insertion of a Thomas cannula into the duodenum opposite the major duodenal papilla) to determine if the increased bile flow produced by the radiographic contrast medium, iodipamide, is canalicular or ductular in origin, to quantitate the choleresis associated with iodipamide and taurocholate excretion, and to correlate these findings with the results of *in vitro* studies in which the osmotic activities of iodipamide and taurocholate in both isotonic saline and bile were determined. A priming injection of 2.5 μCi of [^{14}C]erythritol dissolved in 70% ethanol was given, followed by a continuous infusion of 0.025 μCi/min. Two experiments were performed in each dog by infusion of a 15.3% solution of methylglucamine iodipamide in a stepwise fashion at 7 rates increasing from 0.33 to 7.33 μM/min/kg. Bile samples were collected at each infusion rate after bile flow had been stable for at least 30 min. Blood samples were collected at the midpoint of each bile collection period. In 2 additional studies, iodipamide was infused at the relatively low rate of 1.0 μM/min/kg. In these investigations iodine and [^{14}C]erythritol concentrations were measured in plasma and bile. In another experiment, a 1.5% solution of sodium taurocholate in distilled water was infused in a stepwise fashion at 4 rates increasing from 0.5 to 3.0 μM/min/kg in each of 2 dogs. Iodine and bile salt concentrations were measured in bile. The plasma erythritol clearance increased linearly with the excretion of iodipamide, indicating that iodipamide stimulates canalicular bile flow. The plasma erythritol clearance increased linearly with the excretion of iodipamide, indicating that iodipamide stimulates canalicular bile flow. The choleretic potency of iodipamide (22 ml/mM) was approximately 3 times that of taurocholate (7.8 ml/mM), yet the osmotic activity of iodipamide in bile (1.5 mOsm/mM) was only twice as great as that of taurocholate in bile (0.8 mOsm/mM). The results suggest that per unit of effective osmotic solute secreted, iodipamide carries appreciably more water and diffusible solute into the bile canaliculi than does taurocholate. The reason for this difference is not apparent but possible reasons might include stimulation of active inorganic solute transport by iodipamide, alteration of canalicular membrane permeability by iodipamide, differences in electrical potential associated with transport of iodipamide and taurocholate, delayed reduction in the osmotic activity of iodipamide, and differences between the spatial distribution of the canalicular secretion of iodipamide and taurocholate.

2617 EFFECT OF DEOXYCHOLATE ON THE PEROXIDE OXIDATION OF LIPIDS IN LIVER MICROSOMES. *(E.)* Mishin, V. M.; Lyakhovich, V. V. (Novosibirsk State Med. Inst., USSR). *Biofizika* 19(1):83-86, 1974.

The interdependence between the structural organization of rat liver microsomes modified with a detergent (deoxycholate) and the maximum rate of peroxide oxidation of lipids was investigated. The rat liver microsomes were isolated from a liver homogenate (1 part liver tissue to 2.5 parts of 0.25 M sucrose plus 0.01 M Tris HCl buffer, pH 7.4) by centrifuging for 60 min at 105,000 r.p.m., followed by reprecipitation. The rate of peroxide oxidation of lipids was determined polarographically from the uptake of O_2. Deoxycholate was added to the assay medium before the introduction of the microsomes. Treatment of the rat liver microsomes with deoxycholate at 0.115-0.9 mg/mg microsomal protein increased the activity of peroxide oxidation of lipids dependent on ascorbate. At the same concentrations of deoxycholate the rate of enzymatic peroxidation of lipids dependent on NADP-H did not change. In the presence of deoxycholate there was a fall in the degree of inhibition of peroxide oxidation of lipids by phenergan and ethylene diamine tetraacetate. It is concluded that the degree of integration of the microsomal membrane regulates the processes of peroxide oxidation of lipids. Treatment of the microsomes with deoxycholate apparently increases the binding of Fe^{+++} to the membrane, and, as a consequence, increases the number of radical-forming centers. Large amounts of deoxycholate (greater than 0.7-0.9 mg/mg of microsomal protein) suppress the peroxide oxidation of lipids both of enzymatic and non-enzymatic nature. This is explained by spatial separation of the centers of radical formation and the reaction substrates.

2618 EFFECTS OF PHENOBARBITAL UPON BILE ACID SYNTHESIS IN TWO STRAINS OF RATS. *(E.)*

Cohen, B. I.; Raicht, R. F.; Nicolau, G.; Mosbach, E. H. (Public Health Res. Inst. City New York, Inc., N.Y.). *Lipids* 10(3):168-174, 1975.

The effect of phenobarbital on cholesterol 7α-hydroxylase activity and bile acid output in Wistar and Sprague-Dawley rats was measured. In addition, the amount of biliary cholic acid was correlated with the microsomal 12α-hydroxylase activity in phenobarbital-treated rats. The rats were injected with sodium phenobarbital (100 mg/kg body weight/day) for 8 days. Fecal bile acid excretion was measured on days 6 and 8, and biliary bile acid composition, hepatic microsomal cholesterol, 7α-hydroxylase, and 7α-hydroxy-4-cholesten-3-one 12α-hydroxylase were determined at the end of the experiment. In the Wistar rat, injection of phenobarbital produced a doubling of fecal bile acid output (controls, 5.3 mg/rat/day; treated rats, 10.6 mg/rat/day) and a two- to threefold increase in cholesterol 7α-hydroxylase (13.5 pM 7α-hydroxycholesterol formed/mg protein/min in treated rats; 5.8 pM protein/min in the controls). The fecal bile acid output of Sprague-Dawley rats increased 20% in response to phenobarbital (controls, 9.5 mg/rat/day; treated rats, 11.6 mg/rat/day). The activity of cholesterol 7α-hydroxylase remained unchanged. In both strains, phenobarbital treatment produced a decrease in the proportion of cholic acid in total biliary bile acids (controls, 85%; treated groups, 65%). This was associated with an approximately 50% decrease of 7α-hydroxy-4-cholesten-3-one 12α-hydroxylase activity. Biliary cholesterol concentrations were reduced in phenobarbital-treated rats of both strains, but liver cholesterol concentrations remained unchanged. The drug produced an average 25% increase in liver weight. These findings confirm the previously published suggestion that phenobarbital is potentially useful in the treatment of gallstones since it produces a significant lowering of the relative cholesterol concentration in the bile in treated animals; biliary cholesterol concentrations of treated rats of both strains were decreased significantly. It is further suggested that the *in vitro* assay of cholesterol 7α-hydroxylase activity reflects the state of bile acid synthesis *in vivo* and that the *in vitro* activity of the microsomal 12α-hydroxylase reflects the proportion of cholic acid present in the bile.

2619 COMPARATIVE EFFECTS OF SODIUM TAURODEOXYCHOLATE AND SODIUM TAUROCHOLATE ON BILE SECRETION IN THE RAT, DOG AND RABBIT. *(E.)* Rutishauser, S. C. B.; Stone, S. L. (Dep. Physiol., Univ. Coll., Cardiff, Wales). *J. Physiol. (Lond.)* 245(3): 583-598, 1975.

The biliary effects of sodium taurodeoxycholate and sodium taurocholate were investigated in anesthetized mongrel dogs and male Wistar rats, and in the isolated perfused rat liver and compared with previously determined effects in rabbits. Sodium taurocholate and sodium taurodeoxycholate were dissolved in 0.9% NaCl (2.0 μM/ml) and were infused i.v. into 7 dogs at rates ranging from 5-120 nM/min g liver. Both bile salts had similar quantitative and qualitative effects on the flow and composition of bile in the dog. The choleretic efficiency of sodium taurocholate was 8.5 ml/mM and that for sodium taurodeoxycholate was 9.6 ml/mM. The bile salts were dissolved in 0.9% NaCl (25-50 μM/ml) and were infused at rates ranging from 20-200 nM/min g liver into anesthetized rats. The bile salts had similar effects on the ionic composition of bile in the rat, but differed in that bile flow was not always directly related to the rate of bile salt secretion in bile, in the experiments with sodium taurodeoxycholate. Sodium taurodeoxycholate was hydroxylated to form sodium taurocholate by the liver of the rat but not by that of the dog. These findings indicate that sodium taurodeoxycholate is not a more efficient choleretic than sodium taurocholate in the rat or dog. This contrasts with the choleretic effects of this bile salt in the rabbit and suggests that sodium taurodeoxycholate is not inherently a good choleretic, but rather that it possesses special properties in the rabbit. It seems that deoxycholate, which is the major bile salt present in rabbit bile, has an important and individual role to play in the formation of bile in the species.

2620 INTERACTION BETWEEN ANTIPYRINE AND THE MICROSOMAL ETHANOL OXIDATION IN RAT LIVER. *(E.)* Andreasen, P. B.; Bremmelgaard, A.; Larsen, B. K. (Rigs Hosp., Copenhagen, Denmark). *Pharmacology* 12(4/5):244-250, 1974.

The effect of antipyrine on the kinetics of ethanol oxidation in isolated microsomes from female Wistar rat livers was investigated. The rats were fasted 16 hr, anesthetized with ether, the liver removed and the microsomes prepared by ultracentrifugation. The microsomes were homogenized and the pooled microsomes from 2 rat livers used in each experiment. The incubation system contained 1.8 μM NADPH, 50 μM $MgCl_2$, 43 μM DL-isocitrate, 0.2 mg protein of isocitrate dehydrogenase, microsomal protein 1 mg/ml, and phosphate buffer pH 7.4 to a final volume of 5 ml. Antipyrine was added to obtain a concentration of 0.1 or 1.0 mM/liter. The mixture was preincubated for 5 min and the reaction started by addition of ethanol. Samples were drawn for analysis by gas chromatography at 0 and 10 min after the start of the reaction. The maximal elimination rate and the half saturation concentration were estimated from Lineweaver-Burk plots by linear regression. The average estimated maximal elimination rate for microsomal ethanol oxidation was 117.0 nM/min/g liver and half saturation concentration was 12.7 nM/liter ethanol. When corrections for microsomal losses during the preparation procedure are considered, the estimated average maximal elimination rate is 292.5 nM/min/g liver. The estimated maximal elimination rate and the half saturation concentration for microsomal ethanol oxidation in the presence of antipyrine at a concentration of 0.1 mM/liter were 123.9 nM/min/g liver. and 22.8 mM/liter, resp., and in the presence of antipyrine at a concentration of 1.0 mM/liter were 120.0 nM/min/g liver and 15.9 mM/liter, resp. There was no statistically significant change in

maximal elimination rate and the half saturation concentration after the addition of antipyrine. The lack of effect of antipyrine on microsomal ethanol oxidation suggests that antipyrine and ethanol may be metabolized by different metabolic pathways in the hepatic microsomes.

2621 EFFECT OF BILE-DUCT LIGATION ON ORGANELLE MARKER ENZYMES IN THE LIVER AND SERUM OF RATS. *(E.)* Peters, T. J.; Neale, G.; Heath, J. R. (R. Postgrad. Med. Sch., London, England). *Clin. Sci. Mol. Med.* 48(4):307-313, 1975.

Sixteen marker enzymes for the principal subcellular organelles of rat liver were assayed in the liver of an inbred strain of male Wistar rats 1 day and 8 days after bile-duct ligation or after laparotomy as a control procedure; alterations in the activities of 8 of these enzymes in serum were also assessed. The microsomal enzymes in liver tissue showed complex changes. Benz[α]pyrene hydroxylase activity, predominantly found in the smooth endoplasmic reticulum, was decreased. Glucose 6-phosphatase activity and ribonucleic acid, which are localized predominantly in the rough endoplasmic reticulum, were increased. The plasma membrane enzyme alkaline phosphatase, increased in activity after bile-duct ligation. No changes in mitochondrial enzyme activities were noted after 1 day but there was a 50% reduction 8 days after ligation. Lysosomal enzyme activities did not change. Liver catalase and D-amino acid oxidase activities showed a slight increase at 1 day postligation but a significant fall by 8 days. Lactate dehydrogenase, a cytosol enzyme, showed a decrease in activity after 1 day but an increase in tissue activities 8 days after ligation. Serum activities of mitochondrial, plasma membrane, microsomal, lysosomal, and cytosol marker enzymes tended to increase postligation, particularly at 8 days. Monamine oxidase, a predominantly mitochondrial enzyme, was greatly elevated in the serum after 1 day but returned to normal levels in 8 days. These studies indicate that all the subcellular organelles of liver tissue are affected by bile duct obstruction. The results further indicate that ultrasensitive methods of enzyme analysis provide a useful tool for exploring subcellular changes in experimentally produced liver disease in animals.

2622 α-NAPTHYL-ISOTHIOCYANATE-INDUCED CHOLESTASIS IN THE RAT: STUDIES OF LIVER PLASMA MEMBRANE ENZYMES. *(E.)* Hertzog, P. J.; Bhathal, P. S.; Dorling, P. R.; LePage, R. N. (Dep. Pathol., Univ. Melbourne, Australia). *Pathology* 7(1):13-23, 1975.

A combined biochemical and morphological study was undertaken of acute α-naphthyl-isothiocyanate-induced cholestasis in female Sprague-Dawley rats. The rats were given a single p.o. dose (100 mg/kg body weight) of α-naphthyl-isothiocyanate in maize oil. Treated and control rats were killed 1, 2, 3, and 7 days after dosing, blood was collected, and liver removed immediately. Small pieces of liver were excised for morphological studies and the rest used for plasma membrane isolation. Conjugated and unconjugated serum bilirubin levels rose to a peak 2 days after treatment and returned to normal by 7 days. The conjugated fraction ranged from 60 to 80% of the total bilirubin levels at the times of maximum jaundice. The activities of 3 liver plasma membrane enzymes, Mg^{++}-ATPase, $(Na^{+}-K^{+})$-ATPase and 5'-nucleotidase, were significantly decreased at 2 days after treatment and returned to normal by day 7, thus varying inversely with the degree of hyperbilirubinemia. Enzyme histochemistry, used to demonstrate canalicular localization of Mg^{++}-ATPase in sections of whole liver and of isolated plasma membrane pellets showed that the reduction in activity was not a uniform partial loss, but represented a range of reductions in most canaliculi, a few remaining with normal staining intensity. Electron microscopic examination of liver sections in the first 3 days posttreatment showed dilatation of biliary canaliculi with almost complete loss of microvilli from most canilicuti and swelling of some of the remaining microvilli. Vesiculation of the endoplasmic reticulum with dissociation of ribosomes was also observed. It is suggested that after α-naphthyl-isothiocyanate intoxication there is a membrane lesion which may be responsible for the observed hyperbilirubinemia due to the failure of secretion of biliary constituents into the canaliculus. More direct studies are necessary, however, to determine whether any one of the enzymes is directly involved in the transport of biliary constituents across the bile canalicular membrane.

2623 ETHANOL METABOLISM IN THE VITAMIN C DEFICIENT GUINEA-PIG. *(E.)* Dow, J.; Goldberg, A. (Stobhill Gen. Hosp., Glasgow, Scotland). *Biochem. Pharmacol.* 24(8):863-866, 1975.

The effects of vitamin C deficiency and chronic ethanol treatment on the hepatic redox state and alcohol dehydrogenase activity was investigated in male albino guinea pigs. The guinea pigs were fed a vitamin C-deficient diet for 14 days. The ethanol pretreated groups were intubated daily with 2.5 g ethanol/kg body weight as a 50% solution. Redox state changes were investigated in guinea pigs that had been fasted overnight (18 hr) on the 14th day, injected i.p. with 1.5 g ethanol/kg body weight as 30% solution, killed 30 min later, and their livers rapidly removed. The rate of elimination of ethanol from the blood was determined in a separate but similarly treated group of animals in which 20 µl blood samples were removed from the ear vein at 1/2 hr intervals for 3 hr and blood ethanol measured by an internal standard gas-liquid chromatography method. Guinea pig liver microsomes were prepared from animals who received the standard treatment for 14 days but received no ethanol for 24 hr prior to sacrifice. Aniline hydroxylase, cytochrome P-450, cytochrome b_5, microsomal ethanol oxidizing system activity, NADPH oxidase activity, catalase activity, alcohol dehydrogenase activity and ascorbic acid levels were measured in the mi-

crosomal preparations. There was a small but significant decrease in the redox state shift with ethanol in both the ethanol pretreated normal and scorbutic animals compared with the untreated controls. No difference in terminal body weight, liver weight, liver/body weight or alcohol dehydrogenase activity was found between any of the groups of animals studied. The liver ascorbic acid content was decreased to 30% of normal values in both the vitamin C-deficient and chronic ethanol treated vitamin C-deficient groups. Microsomal aniline hydroxylase and NADPH oxidase activities were reduced in the vitamin C-deficient groups and the amount of cytochrome P-450 was decreased but there was no change in the *in vivo* rate of ethanol elimination or in the concentration of cytochrome b_5. Chronic ethanol treatment did not induce microsomal enzyme activities or increase the concentration of microsomal electron transport components. No evidence was found for a role *in vivo* for the microsomal ethanol oxidizing system in ethanol metabolism, as a reduction in microsomal enzyme activities and electron transport components had no effect on ethanol elimination *in vivo*. When alcohol dehydrogenase activity is normal, no further systems appear to be required for ethanol metabolism.

2624 REGULATION OF HEPATIC REGENERATION IN RATS BY SYNERGISTIC ACTION OF INSULIN AND GLUCAGON. *(E.)* Bucher, N. L. R.; Swaffield, M. N. (Massachusetts Gen. Hosp., Boston). *Proc. Natl. Acad. Sci. USA* 72(3):1157-1160, 1975.

The function of the pancreatic hormones in hepatic regeneration was examined in eviscerated male Sprague-Dawley rats. The rats were subjected to resection of the gastrointestinal tract, pancreas, and spleen, and maintained by continuous i.v. infusion. Such animals, receiving only electrolytes and glucose, responded to 68% hepatectomy with a significant rise in hepatic DNA synthesis, which was, however, greatly delayed and diminished compared with normal controls. The activity was restored to normal by infusion of insulin and glucagon (supplemented with glucose and amino acids) but not by either hormone alone; it was not decreased by delaying the start of hormone treatment for 6-7 hr after partial hepatectomy. Infusion of insulin and glucagon into rats with intact livers did not appreciably elevate DNA synthesis. In normal rats partial hepatectomy was followed by an abrupt fall in portal vein insulin concentration. These findings suggest that agents other than insulin and glucagon may serve to initiate hepatic regeneration, but that these 2 hormones acting synergistically are major regulators of the rate and perhaps also the extent of the regenerative process.

2625 EFFECT OF LONG-TERM ADMINISTRATION OF DIFFERENT ALCOHOLIC BEVERAGES TO RATS ON LIVER LIPID METABOLISM AND BILE ACID CONJUGATION. *(E.)* Jordo, L.; Olsson, R.; Schersten, T. (Dep. Med., Univ. Goteborg, Sweden). *Digestion* 11(3/4):183-193, 1974.

The effect of various alcoholic beverages (ethanol, brandy, whisky, gin and red wine of cheap qualities) on hepatic triglyceride, phospholipid, and cholesterol concentration, incorporation rate of glycerol into hepatic triglycerides and phospholipids, and bile acid conjugation rate was studied in male Sprague-Dawley rats fed alcohol as 50% of the caloric intake for 8-9 months. Two groups of rats served as controls: one fed glucose instead of alcohol and another fed a standard laboratory diet. A special series of rats fed the same amount of ethanol for 10 days was also investigated. The mean daily food consumption, which was initially about 380 kcal/kg, decreased with the growth of the animals to about 160 kcal/kg toward the end of the experiments. Thus the mean daily alcohol consumption over the whole period was about 20 g/day. Serum ethanol concentrations, measured in 15 animals at different times of the day during the last 2 months, ranged between 55-270 mg/100 ml. In the long-term study no unambiguous changes of hepatic lipid concentration, incorporation rate of glycerol into hepatic lipids, and bile acid conjugation rate were found in the glucose-fed animals. In the 10-day study the ethanol-fed rats showed a 60% increase of hepatic triglyceride concentration and of the incorporation rate of glycerol into hepatic triglycerides as well as 30% increase of the rate of bile acid conjugation compared with glucose-fed controls. The various alcoholic beverages showed almost no differences in their effects on lipid metabolism or bile acid conjugation rate. The results suggest that other pathways for ethanol metabolism than the $NADH_2$-producing alcohol dehydrogenase system become of increased importance with prolonged ethanol administration. In agreement with other studies of similar duration, in which fat constituted less than 20% of the total calories, a persistant steatosis was not found after 8-9 months of ethanol feeding. It is suggested therefore, that ethanol *per se* does not cause persistant fatty liver but that a concomitant high fat intake might be one key factor for a progressive and/or persistent steatosis.

2626 PORTACAVAL SHUNT IN THE RAT: TECHNIQUE AND RESULTS. *(Ger.)* Zelde, O.; Schmitt, C. G. (Surg. Clin., Univ. Marburg/Lahn, Germany). *Z. Gastroenterol.* 12(3):193-200, 1974.

A comparison was made of portacaval shunts with end-to-side and side-to-side anastomoses in male SIV 50 rats. Controls consisted of rats which underwent sham surgery, i.e. the hepatic artery was mobilized from the portal vein. Rats were sacrificed either 21 days or 6 months after surgery, and the condition of the anastomosis was studied by splenoportography. The postoperative mortality was 0% for functional end-to-side and side-to-side anastomoses. By 3 months after surgery, 60% of the rats with end-to-side anastomoses had died and by 6 months, 87%. The corresponding mortality rates for rats with side-to-side anastomoses were 33% and 40%, resp. This suggests that not all blood from the portal vein bypasses the liver in side-to-side anastomoses. Body weights were significantly decreased 6 months after end-to-side anastomoses, but not after side-to-side

anastomoses or sham surgery. In rats with end-to-side anastomoses, the weight of the liver decreased to a greater extent during the first 21 days after surgery than in the other groups of animals; no appreciable change in the weight of the liver occurred thereafter. Histological examination of the liver of rats that died revealed moderate steatosis, cell atrophy, occasional pyknosis and vacuolization of the nuclei and, in some cases, small areas of necrosis. No small scars were found in the hepatic parenchyma which would indicate prior necrosis. On the basis of these findings, portacaval shunts with side-to-side anastomoses are recommended for use as an animal model in patho-physiological investigations since the animals can be followed for a relatively long time after surgery.

2627 THE ROLE OF SEX DIFFERENCES IN THE EFFECT OF ANABOLICS ON THE LIVER. *(E.)* Kulcsar-Gergely, J.; Kulcsar, Á.; Kiss, A. (Univ. Med. Sch., Debrecen, Hungary). *Arzneim. Forsch.* 25(3):417-420, 1975.

Two anabolic steroids, nandrolone phenpropionate and nandrolone decanoate, were studied in Wistar rats to determine whether they had any influence on the course of a given liver function and caused any enzyme induction; whether there were any sex differences when exerting their influence; and, when administered simultaneously with carbon tetrachloride (1.0 ml/kg 3 times a week), how they influenced the severity of the induced liver lesion. Both steroids were administered i.m. in oil injection, a single dose being 25 mg/kg. In continuous treatment the animals were injected 3 times a week. Body weight, wet liver weight, and the protein content of liver homogenates increased under the effect of anabolic treatment. The largest increases were seen in females treated with nandrolone phenpropionate. Hepatic hexobarbital metabolism, measured *in vivo*, was increased by a single dose of anabolic. The prolongation of treatment kept shortening hexobarbital anesthesia in females only. Even 8 weeks after the end of treatment the effect was invariably seen in females but not in males. There was no decline in ovarian function. The hepatotropic effect of anabolic treatment, given simultaneously with carbon tetrachloride, was demonstrated in females. Under the effect of anabolic treatment, hepatic hexobarbital metabolism, which had been impaired by the experimental lesion, remained near the levels of the untreated animals. Previous observations that the ability of steroids to cause enzymatic induction is related to their anabolic character are supported by these findings. Induction was stronger and more long-lasting in females than in males. According to comparative analyses of the effect on the liver, nandrolone phenpropionate is more effective, as the same dose had double the effect of nandrolone decanoate. It is concluded that the effect of anabolics on enzymatic induction may be of therapeutic value when carefully chosen preparations are applied in adequately selected cases and sex differences as well as the kind of liver damage are taken into account.

2628 THE SUBCELLULAR LOCALIZATION OF ALDEHYDE DEHYDROGENASE IN RAT LIVER. *(E.)* Horton, A. A.; Barrett, M. C. (Dep. Biochem., Univ Birmingham, England). *Arch. Biochem. Biophys.* 167(2):426-436, 1975.

Evidence supporting the existence of 3 aldehyde dehydrogenases, betaine aldehyde dehydrogenase and 2 aldehyde dehydrogenases ALDH-I and ALDH-II, in female Wistar rats was confirmed and the localization of these enzymes within the liver cell investigated by extensive subcellular fractionation studies. The subcellular fractionation and subsequent spectrophotometry indicated that betaine aldehyde dehydrogenase is predominantly in the cytosol with about 5% in the mitochondria. Of the aldehyde dehydrogenase activity (ALDH-I plus ALDH-II), 80% was found in the mitochondria and 20% in the microsomal fraction. Of the 2 enzymes, ALDH-I was exclusively mitochondrial and ALDH-II was distributed between mitochondria and microsomes. Submitochondrial fractionation indicated that betaine aldehyde dehydrogenase and ALDH-I are located in the matrix and ALDH-II is located chiefly in the outer membrane. These studies confirm the existence of 3 aldehyde dehydrogenases in the rat liver cell.

2629 EXPERIMENTAL STUDIES ON LIPID AND CARBOHYDRATE METABOLISM IN HUMAN LIVER BIOPSIES. *(Ger.)* Oette, K. (Med. Clin., Univ. Cologne, Germany). *Klin. Wochenschr.* 52(20):956-965, 1974.

Research on the effect of dietary fat and carbohydrate on lipid and carbohydrate metabolism in the human liver is reviewed. Studies were performed on human liver biopsies obtained with a Menghini needle and weighing 5-40 mg. When linolenic acid (40-100 g) was added to the diet as a metabolic indicator for long-chain fatty acids, no more than 12% was recovered from the liver, the amount depending upon the linolenic acid content of the diet. In two patients with minor atypical parenchymal changes but no steatosis, more linolenic acid was present in the phosphatide than in the glyceride fraction 5-6 hr after administration. Addition of 1-^{14}C-linolenic acid to the diet had no effect on the enzymes involved in fatty acid uptake and esterification in the liver, and the ratio of dietary carbohydrate to fat had no effect on total uptake nor on incorporation of fatty acids into the various lipid fractions. Diets with lower fat or higher carbohydrate contents reduced incorporation of 1-^{14}C-acetate into total lipids in the human liver. This anomalous finding is attributed either to intracellular dilution of 1-^{14}C-acetate by increased synthesis of inactive acetyl-coenzyme A from glucose or to a deficiency of coenzyme A (competitive inhibition). When a high-fat diet was administered, 1-^{14}C-acetate was used almost exclusively for chain lengthening, and the C_{20}-C_{22} polyunsaturated fatty acids formed were preferentially incorporated into the phosphatide fraction. Studies on the metabolism of U-^{14}C-hexoses and U-^{14}C-glycerol in the human liver revealed that, under the experimental and dietary conditions employed, glucose, fructose, and galactose were in-

corporated into the glycogen and glyceride fractions in the liver and only small amounts were used for *de novo* fatty acid synthesis. When the diet contained about 30-45% fat, calculated on a caloric basis, the rate of *de novo* phosphatide synthesis in the human liver was more than twice the rate of fatty acid synthesis when fructose was used as the carbohydrate. Fructose and galactose were used for glycogen synthesis to about the same extent, while glucose was used in far larger quantities. In the *in vitro* system employed, degradation products of fatty acids, particularly stearic acid, and fructose, rather than glucose, were the preferred precursors of cholesterol. A high-fat diet did not increase the rate of cholesterol synthesis. However, administration of ethanol for several days increased the rate of cholesterol, but not that of cholesterol ester, synthesis. If the results of these experiments can be extrapolated to *in vivo* conditions and plasma lecithin-cholesterol acyltransferase activities are taken into account, these findings confirm that the human liver is of minor importance for the synthesis of cholesterol esters.

2630 SYNTHESIS OF THE SULFATE ESTERS OF BILE ACIDS IN THE PERFUSED RAT LIVER AFTER BILE DUCT OCCLUSION. *(Ger.)* Liersch, M.; Stiehl, A. (Med. Clin., Univ. Heidelberg, Germany). *Z. Gastroenterol.* 12(2):131-134, 1974.

Synthesis of the sulfate esters of bile acids was studied in isolated perfused livers from male Sprague-Dawley rats. Cholestasis was induced 1-3 weeks before perfusion or immediately before perfusion with a hemoglobin-free medium (100 ml Krebs-Henseleit solution, 2.5 g bovine serum albumin, and 5.5 mM glucose) to which lithocholic acid (0.12 mM) or other ^{14}C-labeled bile acids (0.25×10^{-3} M) had been added. While livers from intact rats rapidly extracted bile acids from the perfusion medium, cholestatic livers removed only about 6 µM in 150 min of perfusion. After 150 min of perfusion, about 35% of lithocholic acid, but only 1-2% of cholic and chenodeoxycholic acids, had been converted to their sulfate esters. The duration of cholestasis had no effect on synthesis of the sulfate ester of lithocholic acid, but synthesis of the sulfate ester of taurocholic acid increased with the duration of cholestasis. Sulfate esters of taurocholic acid accounted for 2.6% of this when the bile ducts were occluded immediately before perfusion, but for 6% and 8% after 1 and 2 weeks of cholestasis, resp. Thin-layer chromatographic analysis of the medium after perfusion with free bile acids revealed that more than 95% of the bile acids were present in conjugated form after 150 min. Studies with cell-free extracts are being performed to determine whether free bile acids have to undergo conjugation with taurine before they can be converted to their sulfate esters.

2631 EXPERIMENTAL ALCOHOL-INDUCED HEPATIC NECROSIS: SUPPRESSION BY PROPYLTHIOURACIL. *(E.)* Israel, Y.; Kalant, H.; Orrego, H.; Khanna, J. M.: Videla, L.; Phillips, J. M. (Dep. Pharmacol., Univ.. Toronto, Canada). *Proc. Natl. Acad. Sci. USA* 72(3): 1137-1141, 1975.

The hypothesis that the hypermetabolic state that exists in the livers of animals treated chronically with ethanol produces a relative hypoxia in the centrilobular zone of the liver which, if severe enough, leads to cellular death and the production of hepatitis was tested in male Wistar rats. Rats consuming ethanol (35% of the total calories) for 30 days, given with a nutritionally adequate diet, and exposed to reduced oxygen tensions (11, 7.5, or 5%, the remainder being pure nitrogen) for 6 hr, developed histological and biochemical evidence of hepatocellular necrosis and inflammatory lesions confined to the centrilobular zone. The severity was proportional to the degree of hypoxia. Pair-fed (nonalcohol) controls showed no such lesions. Treatment of the animals with 6-propyl-2-thiouracil (5 mg/100 g daily) abolished the hypermetabolic state of the liver in ethanol-consuming animals, and reduced the histological and biochemical effects of hypoxia. Since 6-propyl-2-thiouracil reduced both the hypermetabolic state of the liver and susceptibility of the liver to damage by hypoxia in animals treated chronically with ethanol, it is concluded that the hypermetabolic state may be responsible for the supersensitivity to hypoxia. If a hypermetabolic state also occurs in the liver of the alcoholic patient, it is conceivable that a reduction in the availability of oxygen to the liver could explain the production of alcoholic hepatitis and that 6-propyl-2-thiouracil could also be therapeutically effective in the treatment of alcholic hepatitis in man.

2632 THE DISTRIBUTION OF BILE ACIDS IN HEPATOCYTES IN EXTRAHEPATIC CHOLESTASIS. II. *(Ger.)* Leuschner, U.; Kurtz, W.; Alfurayh, A.; Erb, W.; (Cent. Intern. Med., Johann Wolfgang Goethe Univ., Frankfurt/Main, Germany). *Z. Gastroenterol.* 12(3):163-168, 1974.

Extrahepatic cholestasis was induced in 17 male Wistar rats by double ligation of the bile duct, severing it just before the opening into the small intestine. After 17 days the rats were sacrificed and their livers were removed along with the dilated extrahepatic bile ducts. The larger intrahepatic bile ducts were emptied by gentle compression, bile was cleaned off from the surface of the liver, and the hepatic vein was perfused several times with a solution containing 0.3 M KCl and 0.05 of potassium EDTA. Liver homogenate was then fractioned in the above solution by differential centrifugation, and the fractions were analyzed for bile acids by gas chromatography. The mean bile acid content of a liver weighing 13.5 g was 157.6 µg. Of this bile acid, 8.3% was found in the mitochondria, 23.4% in the microsomes, and 68.3% in the supernatent or cytoplasmic fraction. In all three fractions the bile acid present in the highest concentration was cholic acid. While the highest concentrations of cholic acid were found in the microsomes and super-

natant, the highest concentrations of β-muricholic and lithocholic acids were detected in the mitochondria and microsomes. Chenodeoxycholic acid was distributed uniformly throughout all fractions. In all fractions, total dihydroxy (deoxycholic and chenodeoxycholic) acids were present in concentrations less than 1/10 of the concentrations of trihydroxy (cholic and β-muricholic) acids. A comparison of these findings with the distribution of bile acids in the liver of normal rats showed that the total bile acid content was 69% lower in extrahepatic cholestasis. Bile acids were 34% lower in the mitochondria, 88.4% lower in the microsomes, but 102% higher in the supernatant. It is suggested that an increase in the concentration of trihydroxy bile acids results in impairment of synthesis in the hepatocytes in extrahepatic cholestasis.

2633 INFLUENCING THE MICROSOMAL ENZYME ACTIVITY IN THE RAT LIVER BY ETHANOL WITH AND WITHOUT DRUGS. *(Ger.)* Bode, C.; Bode, J. C.; Martini, G. A. (Med. Clin., Univ. Marburg, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:909-910, 1973.

Groups of 8-10 male Wistar rats were given a standard diet containing 20% protein *ad libitum* and: 1) water; 2) 15% (w/v) ethanol solution *ad libitum*; 3) 15% ethanol solution *ad libitum* and 5 g/kg/day ethanol p.o. through a tube; 4) water and 100 mg/kg/day phenobarbital; and 5) water, 100 mg/kg/day phenobarbital, 15% ethanol *ad libitum*, and 5 g/kg/day ethanol p.o. through a tube. Two other groups of rats received a low protein diet (5% protein) with: 6) water; or 7) 15% ethanol solution *ad libitum* and 5 g/kg/day ethanol p.o. The activities of acetanilide hydroxylase (AAH) and NADPH- and NADH-dependent cytochrome c reductase (CcR) were reduced to about 50% of control values in groups 2 and 3, while activities of steroid reductase (SR) and glucose-6-phosphatase (G-6-P) were reduced by 150-200%. No significant differences in enzyme activities were found between group 2 and 3. In group 4, phenobarbital had no effect on the activities of AAH or NADH-dependent CcR, but it did increase the activities of NADPH-dependent CcR, SR, and G-6-P. In group 5, administration of both alcohol and phenobarbital increased only the activity of G-6-P; no changes occurred in the activities of the other enzymes studied. In group 6 a low-protein diet reduced the activities of AAH and NADH- and NADPH-dependent CcR to about 20-30% of control values. Combination of a low-protein diet with ethanol (group 7) had no further effect on microsomal enzyme activity. G-6-P activity was twice that of control values in groups 6 and 7, while SR activity was significantly reduced in groups 6 and 7. These findings demonstrate that ethanol has different effects on microsomal enzyme activity. The fact that chronic alcoholics sometimes eat protein-deficient diets and ingest sedatives or other drugs may account for reported discrepancies in drug metabolism in alcoholism.

2634 HORMONAL INFLUENCES IN THE DEVELOPMENT OF THE HYPERMETABOLIC STATE OF THE LIVER PRODUCED BY CHRONIC ADMINISTRATION OF ETHANOL. *(E.)* Bernstein, J.; Videla, L.; Israel, Y. (Dep. Pharmacol., Univ. Toronto, Canada). *J. Pharmacol. Exp. Ther.* 192(3):583-591, 1975.

The relative participation of adrenaline and of thyroid hormones in the production of a liver hypermetabolic state induced by chronic ethanol administration was investigated in male Wistar rats. The animals were given ethanol by gastric intubation for 15-19 days in increasing doses: 3 g/kg for 3 days (as 20 w/v solution); 4 g/kg for 3 days (25% solution); 5 g/kg for 3 days (30% solution); and 6 g/kg (35% solution) for the remaining period. Thyroidectomized, adrenalectomized, and control animals in the ethanol-treated groups weighed 10-20 g less than dextrose-treated groups at the end of the treatment. In another experiment, animals were given liquid diets in which ethanol provided 35% of the total calories. Chronic administration of ethanol to the rats led to the development of a hypermetabolic state of the liver. The calorigenic effects produced by ethanol, measured in liver slices, could by reproduced by a single large dose of epinephrine (2 mg/kg s.c.). Oxygen consumption by liver slices of animals given this large dose of epinephrine bitartrate increased 40-50%. In these livers all the extra oxygen consumption, but not the basal respiration, could be abolished by ouabain, an inhibitor of the sodium pump. 2,4-Dinitrophenol did not affect the respiratory rate in the liver of epinephrine-treated animals but markedly increased that in controls. In the livers of treated animals, the activating effect of 2,4-dinitrophenol was recovered in the presence of ouabain. The calorigenic effect of epinephrine in the liver was completely abolished by phentolamine (α-adrenergic blocker) but was not modified by DL-propranolol (β-adrenergic blocker). The calorigenic effects produced by epinephrine were not seen in thyroidectomized animals or by incubating the liver slices in a calcium-free medium. It is concluded that thyroidectomy and administration of phentolamine markedly reduced, and adrenalectomy completely abolished, the hypermetabolic state produced in the liver of rats by chronic administration of ethanol.

2635 STEROID PROTECTION OF THE LIVER DURING EXPERIMENTAL ISCHEMIA. *(E.)* Figueroa, I.; Santiago-Delpin, E. A. (Univ. Puerto Rico Med. Sch., San Juan). *Surg. Gynecol. Obstet.* 140(3):368-370, 1975.

The effect of steroids during transitory experimental warm hepatic ischemia was investigated in rabbits in which total hepatic ischemia was produced by ligating the portal triad and gastrohepatic ligament for 30 min. A survival rate of 10% was obtained in controls. If methylprednisolone was given (30 mg/kg i.v.) 5-10 min prior to occlusion, 100% of the rabbits survived. If methylprednisolone was given (30 mg/kg i.v.) immediately after occlusion, the survival rate was 54%. Further experiments extending occlusion to 1 hr resulted in a 50% survival rate with prior methylprednisolone administration as compared with no survivors among controls. Two hypotheses on the mechanism of methylprednisolone protection of the liver during

ischemia are presented: 1) methylprednisolone prolongs the tolerance to actual ischemia by protecting the cell membrane or by stabilizing the lysozomal membrane of the ischemic hepatic cell; or 2) it inhibits or blocks the effect on the cardiovascular system of already circulating toxic substances liberated from the liver during the ischemic period. The fact that treatment before occlusion resulted in a more prolonged survival time than treatment after occlusion suggests that the first hypothesis is probably the most important one, even though the second must be operational as well.

2636 EFFECTS OF CHRONIC ETHANOL TREATMENT AND THYROXINE ADMINISTRATION ON ETHANOL METABOLISM AND LIVER OXIDATIVE CAPACITY. *(E.)* Israel, Y.; Videla, L.; Fernandex-Videla, V.; Bernstein, J. (Dep. Pharmacol., Univ. Toronto, Canada). *J. Pharmacol. Exp. Ther.* 192(3):565-574, 1975.

The rate of ethanol metabolism *in vivo* and by liver slices *in vitro* in male Wistar rats treated with thyroxine, was investigated in an effort to determine the cause for previously published contradictory reports on the effect of thyroid hormones on the rate of ethanol metabolism. The rats were given nutritionally complete liquid diets providing 35% of the total calories as ethanol for 21-27 days. The average daily alcohol intake of animals was 14.3 g/kg/day. This chronic administration of ethanol led to an increased rate of ethanol metabolism *in vivo* and *in vitro*. *In vitro* studies in liver slices showed that ouabain, an inhibitor of the $Na^+ + K^+$-activated ATPase, completely blocked the extra ethanol metabolism elicited by chronic ethanol treatment. 2,4-Dinitrophenol increased the rate of ethanol metabolism in the livers of the treated animals only in the presence of ouabain. Administration of thyroxine led to an increase in the rate of ethanol metabolism when measured both *in vitro* and *in vivo*. This effect was biphasic; an activation occurred only with low doses of thyroxine but disappeared after administration of larger doses. Alcohol dehydrogenase activity in the liver of the animals treated with large doses of thyroxine was reduced significantly. With the doses used (50-1000 g/kg), thyroxine also increased the rate of oxygen consumption as measured in liver slices. However, a biphasic effect did not occur. A near maximum activation on the rate of oxygen consumption occurred with low doses of thyroxine (100 µg/kg). Oxygen consumption was also increased in the livers of animals chronically treated with ethanol. A maximal effect was produced after 18-21 days of treatment. For both ethanol and thyroxine-treated animals, an increased rate of oxygen consumption occurred with a concomitant loss of dinitrophenol effect. Mitochondrial-glycerophosphate oxidase was increased in the liver of animals treated with ethanol or with thyroxine. In these two groups, this enzymatic activity appeared to be less affected by the treatment than the 2,4-dinitrophenol-activated respiration. Although these results show that chronic treatment with ethanol produces many changes in the liver that are similar to those produced by thyroid hormones, it is concluded that it is not possible to ascertain that the chronic effects of ethanol were only mediated by thyroid hormones.

2637 UDP-GLUCURONYLTRANSFERASE IN PERFUSED RAT LIVER AND IN MICROSOMES: INFLUENCE OF PHENOBARBITAL AND 3-METHYLCHOLANTHRHENE. *(E.)* Bock, K. W.; White, N. H. (Toxicol. Inst., Tubingen, Germany). *Eur. J. Biochem.* 46(3):451-459, 1974.

1-Naphthol glucoronide formation and liver uridine diphosphate (UDP)-glucuronate levels were determined in perfused livers from control, phenobarbital treated and 3-methyl cholanthrene-treated rats, and the rates of glucuronidation compared with UDP-glucuronyltransferase activity in native and microsomal preparations activated by Triton X-100 *in vitro*. Male Sprague-Dawley rats received 3 daily i.p. injections of 100 mg/kg/ phenobarbital and were sacrificed on the fourth day. Those rats treated with 3-methylcholanthrene were injected once i.p. with 40 mg/kg in olive oil; hepatectomy was performed on the fourth day. Galactosamine-HCl (400 mg/kg) was injected once i.p. 3 hr before sacrifice. Liver microsomal UDP-glucuronyltransferase (1-naphthol as substrate) was activated about 10-fold by treatment of native microsomes *in vitro* with Triton X-100. Following pretreatment with 3-methylcholanthrene or phenobarbital the specific activities of detergent-activated microsomes were increased about 300% and 40%, resp. In isolated liver perfused with 0.5 mM 1-naphthol, the rate of glucuronidation of naphthol as determined by the appearance of naphthol glucuronide in the perfusate, bile and liver tissue, was 0.1 µM/min/g liver. This rate of glucuronidation was increased by 70% in rats pretreated with 3-methylcholanthrene and 140% following phenobarbital treatment. A UDP-glucuronic acid level of 0.3 µm/g liver was determined in perfused liver from control rats. This level remained unchanged during perfusion with 0.5 mM 1-naphthol. In the perfused liver from phenobarbital or 3-methylcholanthrene treated rats, the UDP-glucuronate level increased to 0.5 µM/g liver. In control, 3-methylcholanthrene or phenobarbital-treated rats, rates of glucuronidation of 1-naphthol in the perfused liver system correspond best with the UDP-glucuronyltransferase activities determined in native microsomes when the different UDP-glucuronate levels, microsomal protein contents and liver weights are taken into account. The results suggest that the enzyme is mostly latent in the microsomal membrane and that this latency is increased after pretreatment of rats with 3-methylcholanthrene despite the marked enzyme induction.

2638 THE CHOLERETIC MECHANISMS OF SODIUM TAUROCHOLATE, SECRETIN, AND GLUCAGON. *(E.)* Russell, T. R.; Searle, G. L.; Jones, R. S. (VA Hosp., San Francisco, Calif.). *Surgery* 77(4):498-504, 1975.

The choleresis stimulated by sodium taurocholate, secretin, and glucagon was compared as was the effect of each of these substances on canalicular secretion as estimated by the biliary clearance of erythritol. Three mongrel dogs were prepared by cholecystectomy, ligation of the lesser pancreatic duct, and insertion of modified Thomas cannulas into the duodenum and

stomach. After recovery from surgery, experiments were performed (as often as 3 times weekly but never on successive days) by cannulation of the common bile duct for bile collection through the duodenal cannula. After cannulation, bile and gastric juice were collected continuously at 15 min intervals for the duration of the experiment. Sodium chloride solution (0.9%) was infused i.v. throughout all experiments. Choleretic test substances were added at the end of the eighth 15-min period and the dose of each substance increased hourly for the remainder of the experiment. At the end of the fourth 15-min period, 3 μCi ^{14}C-labeled erythritol was injected i.v. and an i.v. infusion of [^{14}C]erythritol begun and continued at a rate of 3 μCi/hr for the remainder of the experiment. All test substances caused increased bile secretion. Sodium taurocholate caused a marked increase in bile salt output and in the biliary clearance of erythritol. Secretin caused a large increase in bile flow, no increase in bile salt output, and a very small increase in the biliary clearance of erythritol. The results indicate marked differences in the choleretic mechanism of sodium taurocholate and secretin and suggest that the principal action of taurocholate is on the canaliculi and the principal action of secretin is on the ducts.

2639 TIME COURSE OF PROTECTION BY N,N'-DIPHENYL-p-PHENYLENDIAMINE (DPPD) AGAINST CARBON TETRACHLORIDE HEPATOTOXICITY. *(E.)* Torrielli, M. V.; Ugazio, G.; Gabriel, L.; Burdino, E. (Inst. Gen. Pathol., Univ. Turin, Italy). *Agents Actions* 4(5):383-390, 1974.

The mechanism of protection by *N,N'*-diphenyl-*p*-phenylenediamine (DPPD) against carbon tetrachloride intoxication was investigated in male Wistar rats. DPPD was suspended in 2.5% acacia gum and given i.p. 60 mg/100 g 48 and 24 hr before intoxication. CCl_4, either 25 or 250 μl/100g, was given p.o. in mineral oil. The preliminary treatment with DPPD prevented liver fatty infiltration after CCl_4 poisoning. Double bond shifting in microsomal lipids was depressed 30 min after intoxication. A more active protection took place with low doses of CCl_4 than after a large dose. In later stages of CCl_4 challenge, both triglyceride accumulation and lipid peroxidation took place in spite of DPPD treatment. However, they were less severe and more transient than in unprotected animals. Liver necrosis, as evidenced by changes in serum activity of alanine aminotransferase, was prevented by DPPD. When animals treated with either DPPD or its suspending medium were given ^{14}C-labeled CCl_4, and the exhaled $^{14}CO_2$ assayed by liquid scintillation spectrometry and the lipid-bound radiocarbon was assayed, it was found that DPPD did not interfere with the hepatic metabolism of CCl_4. Pretreatment with DPPD partially inhibited the *in vitro* demethylation of aminopyrine by liver microsomes and significantly potentiated the hypnotic effect of hexobarbital (12 mg i.p.). When injected along with phenobarbital (8 mg/100 g/day i.p. for 3 days), DPPD blocked the barbiturate stimulation of microsomal enzymes. A combined dosing with DPPD and CCl_4 caused a more severe inhibition of demethylase activity and hexobarbital metabolism. It is concluded that *N,N'*-diphenyl-*p*-phenylenediamine interferes with the metabolism of CCl_4 only up to the threshold level covering the development of the most common secondary phenomena induced by this haloalkane, but that the non-inhibited cleavage of carbon tetrachloride allows the primary attack to take place and to progress up to a certain extent.

2640 ETHANOL METABOLISM AND LIVER OXIDATIVE CAPACITY IN COLD ACCLIMATION. *(E.)* Videla, L.; Flattery, K. V.; Sellers, E. A.; Israel, Y. (Dep. Pharmacol., Univ. Toronto, Canada). *J. Pharmacol. Exp. Ther.* 192(3):575-582, 1975.

The role of the $Na^+ + K^+$-activated ATPase system in changes leading to an increased oxidative capacity and an increased ethanol metabolism in the livers of male Wistar rats exposed to 5 C for 4 - 6 weeks was investigated. The animals were supplied with food and water *ad libitum*. The cold exposure led to 30-80% increases in the rate of oxygen consumption and a 50% increase in the rate of ethanol oxidation by liver slices, a 50% increase in mitochondrial α-glycerophosphate oxidase activity of liver, and a 100% increase in $Na^+ + K^+$ -activated ATPase activity. Ouabain (1mM), an inhibitor of the $Na^+ + K^+$ -activated ATPase, completely blocked the extra respiration and ethanol oxidation. 2,4-Dinitrophenol, which increases oxygen consumption and ethanol oxidation by liver slices from normal rats, was ineffective with slices from cold-exposed animals. The ethanol disappearance rate *in vivo* was also increased by cold acclimation, even though liver alcohol dehydrogenase activity was reduced. It is suggested that increased hydrolysis of ATP by the sodium pump system is responsible for the increased oxygen consumption and ethanol metabolism in the livers of cold-acclimated animals.

2641 SEQUENTIAL PRODUCTION OF FATTY LIVER, HEPATITIS, AND CIRRHOSIS IN SUB-HUMAN PRIMATES FED ETHANOL WITH ADEQUATE DIETS. *(E.)* Lieber, C. S.; DeCarli, L. M.; Rubin, E. (VA Hosp., Bronx, N.Y.). *Proc. Natl. Acad. Sci. USA* 72(2):437-441, 1975.

An experimental model has been developed that reproduces the sequential development of all the liver lesions seen in the human alcoholic. Nine pairs of baboons were pair-fed an alcohol-containing or control liquid diet for 8-22 months, with the average length of treatment being 15 months. An additional group of 12 animals that had been given a solid diet with either alcohol or carbohydrates in the drinking water for a period varying from 17-34 months were changed to the liquid diet for an average of 17 months. The protein content of the diet (18% of total calories) corresponded to that of commonly used commercial diets that are satisfactory for the baboon. The incorporation of the ethanol (50% of total calories) in a totally liquid diet permitted the maintenance of a nutritionally adequate regimen despite the intake of

inebriating amounts of ethanol. In the 15 baboons fed ethanol, all developed fatty liver, five progressed to hepatitis, and five had cirrhosis. Upon ethanol withdrawal, signs of physical dependence, such as seizures and tremors, developed. Surgical biopsies of the liver were performed at regular intervals under anesthesia. Ultrastructural changes of the mitochondria and the endoplasmic reticulum were already present at the fatty liver stage and persisted throughout hepatitis and cirrhosis. The lesions were similar to those observed in alcoholics (including the inflammation and the central sclerosis) and differed from the alterations produced by choline and protein deficiencies. At the fatty liver stage, some adaptive increases in activity of microsomal enzymes (aniline hydroxylase and the microsomal ethanol oxidizing system) were observed, but these tended to disappear with the development of hepatitis and cirrhosis. Fat accumulation was also much more pronounced in the animals with hepatitis as compared with those with simple fatty liver (an 18-fold compared with 3- to 4-fold increase in liver triglycerides). The demonstration that these lesions can develop despite an adequate diet indicates that in addition to correction of the nutritional status, control of alcohol intake is mandatory for the management of patients with alcoholic liver injury.

2642 THE INTERACTION OF VASOACTIVE INTESTINAL POLYPEPTIDE AND SECRETIN WITH LIVER-CELL MEMBRANES. *(E.)* Desbuquois, B. (INSERM, Hosp. Sick Child., Paris, France). *Eur. J. Biochem.* 46(3):439-450, 1974.

The interaction of vasoactive intestinal polypeptide (VIP) and secretin with isolated rat liver-cell membranes was investigated using ^{125}I-labeled derivatives of the hormones. Incorporation of iodine did not appreciably affect the ability of VIP to stimulate the activity of adenylate cyclase in liver membranes, but caused a 2-3 fold decrease in the apparent affinity of secretin towards this enzyme. Native VIP and secretin readily displaced [^{125}I]VIP specifically bound to liver cell membranes; about 100 times greater concentrations of secretin were necessary to achieve effects similar to those observed with VIP. Synthetic secretin displaced the VIP-membrane complex identically to natural secretin. The labeled material dissociated from the VIP-membrane complex retained the ability of unused VIP to bind to membranes but VIP in the incubation medium was rapidly inactivated upon exposure to membranes and to certain polypeptides, such as bacitracin. At 23 C, the rate of VIP-membrane association was 1.3×10^7/M/sec and the rate of dissociation, 2.3×10^{-3}/sec. The dissociation constant based on these rate constants is 0.17 nM; the value of 0.16 nM was obtained separately from equilibrium data. Binding of VIP to membranes was reduced by increasing the ionic strength of the medium. Maximum binding occurred at pH 7.4. Nucleoside di- and triphosphates decreased the binding of VIP to membranes at equilibrium and increased the rate of dissociation of the VIP-membrane complex. Digestion of the membranes with trypsin and phospholipase A resulted in a loss of the ability of these membranes to bind VIP. [^{125}I]secretin bound specifically to liver membranes. Binding was competitively inhibited by native secretin and VIP in a closely similar fashion to that of [^{125}I]VIP. Only a small fraction (2-3%) of the medium secretin bound to membranes. At equivalent concentrations, the iodinated derivative of natural secretin bound to membranes more effectively than that of the synthetic peptide. After incubation of natural [^{125}I]-secretin with liver membranes, the radioactive material eluted from the membranes with urea was about 3 times more potent than unused secretin in its ability to bind to fresh membranes. These findings suggest that a fraction of the iodinated derivative of natural secretin which binds to membranes is probably iodinated VIP present as a contaminant. It is further suggested that the vasoactive intestinal polypeptide binding structures identified in liver cell membranes represent biological receptors for this hormone.

2643 MULTICOMPARTMENTAL ANALYSES OF TWO- AND THREE-EXPONENTIAL PLASMA DISAPPEARANCE CURVES AFTER INTRAVENOUS INJECTION OF ^{14}C-CHOLIC ACID, SULFOBROMOPHTHALEIN, AND ^{14}C-BILIRUBIN: THEIR VALUE IN QUANTITATIVE STUDIES OF HEPATIC EXCRETION. *(Ger.)* Klapdor, R.; Eppers, J. (1st Med. Clin., Univ. Hamburg, Germany). *Z. Gastroenterol.* 12(1): 1-8, 1974.

In a study of eight miniature pigs, anesthetized with pentobarbital sodium, it was demonstrated that the distribution and excretion of ^{14}C-cholic acid, BSP, and ^{14}C-bilirubin after a single i.v. injection can be calculated from 3-exponent plasma clearance curves by a 3-compartment metabolic model. This model was derived from a 2-compartment model used to analyze 2-exponent plasma clearance curves after i.v. injection of these substances. Since plasma clearances after a single i.v. injection of ^{14}C-cholic acid, BSP, and ^{14}C-bilirubin can be described, in most cases, as 2- or 3-exponent, these substances can be employed as bile markers. By comparing calculated values for these substances and their concentrations measured in the bile or duodenal juice, it is possible to detect impairment of bile flow or a loss of hepatic bile on its course from the liver to a tube, no matter whether this loss results from discharge into the gallbladder or incomplete aspiration of duodenal juice.

2644 BIOLOGICAL PROBLEMS IN LIVER REGENERATION. *(E.)* Karon, H. (Rasceja Munic. Hosp., Poznan, Poland). *Acta Hepatogastroenterol. (Stuttg.)* 21(6):403-410, 1974.

2645 A SIMPLE DEVISE FOR TRANSPLANTATION OF LIVER TISSUE IN THE RAT. *(E.)* Gallup, D. A.; Roy, A. K. (Dep. Biol. Sci., Oakland Univ., Rochester, Mich.). *Fed. Proc.* 34(3):394, 1975.

2646 EVISCERATED RATS WITH PRESERVED LIVER FUNCTION. *(E.)* Penhos, J. C.; Branoff, R.; Montalbert-Smith, M.; Ramey, E. (Georgetown Univ. Med. Cent., Washington, D.C.). *Fed. Proc.* 34(3):394, 1975.

2647 PORTACAVAL SHUNT IN THE NORMAL RAT. (ii) A STUDY OF IMMUNOLOGICAL CHANGES WITH HISTOLOGY AND RADIOLOGY. *(E.)* Meyers, I.; Hickman, R.; Latham, J.; Keraan, M.; Engelbrecht, G. H. C.; Terblanche, J.; Saunders, S. J. (Dep. Med., Univ. Cape Town, South Africa). *S. Afr. J. Surg.* 12(2): 79, 1974.

2648 A COMPARATIVE STUDY OF THE EFFECTS OF PORTACAVAL SHUNTING AND SHAM LAPAROTOMIES ON YOUNG PIGS. *(E.)* Crosier, J.; Immelman, E.; Hickman, R.; Webber, B.; Uys, C. J.; Terblanche, J. (Dep. Surg., Univ. Cape Town, South Africa). *S. Afr. J. Surg.* 12(2):79, 1974.

2649 THE INFLUENCE OF PORTACAVAL ANASTOMOSIS ON CYTOPLASMIC, MITOCHONDRIAL, AND MICROSOMAL ENZYME ACTIVITY IN NORMAL AND CIRRHOTIC RAT LIVER. *(Ger.)* Bode, J. C.; Bode, C.; Zelder, O.; Middeler, A. (Med. Clin., Univ. Marburg, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:919-922, 1973.

2650 EFFECTS OF HEPATECTOMIZED AND OTHER RAT SERA ON THE GROWTH OF FIBROBLASTS IN VITRO. *(E.)* Demeteriou, A. A.; Rettura, G.; Schittek, A.; Seifter, E.; Levenson, S. M. (Albert Einstein Coll. Med., Yeshiva Univ., Bronx, N.Y.). *Fed. Proc.* 34(3):844, 1975.

2651 EXPERIMENTAL AND CLINICAL STUDIES ON THE INCREASE IN SERUM GAMMA-GLUTAMYLTRANSPEPTIDASE ACTIVITY IN HEPATOBILIARY DISEASE. *(Ger.)* Thiele, K. G.; Holmes, A. W.; Mattenheimer, H. (Med. Polyclin., Univ. Cologne, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:925-927, 1973.

2652 PRIMARY AND SECONDARY BIOCHEMICAL RESPONSE OF THE LIVER FOLLOWING D-GALACTOSAMINE ADMINISTRATION DURING THE GENESIS OF GALACTOSAMINE HEPATITIS. *(Ger.)* Reutter, W.; Bauer, C.; Bachmann, W.; Lesch, R. (Inst. Biochem., Univ. Freiburg, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:927-930, 1973.

2653 RELATION BETWEEN THE ACTIVITY OF THE DRUG-METABOLIZING ENZYME SYSTEM OF THE LIVER AND THE COURSE OF EXPERIMENTAL HEPATIC COMA IN ANIMALS. *(Ger.)* Brachtel, D.; Thiel, H.; Zilly, W.; Richter, E. (Med. Clin., Univ. Wurzburg, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:917-919, 1973.

2654 EFFECT OF SEX AND CASTRATION ON HEPATIC AND INTESTINAL ACTIVITY OF DRUG-METABOLIZING ENZYMES. *(E.)* Hietanen, E. (Dep. Physiol., Univ. Turku, Finland). *Pharmacology* 12(12):84-89, 1974.

2655 SPECIFICITY OF ANDROGEN STIMULATION OF HEPATIC MICROSOMAL DRUG METABOLIZING ACTIVITY. *(E.)* Brown, T. R.; Greene, F. E. (M.S. Hershey Med. Cent., Pennsylvania State Univ., Hershey). *Fed. Proc.* 34(3):725, 1975

2656 INDUCTION AND INHIBITION OF HEPATIC MICROSOMAL DRUG METABOLIZING ENZYMES BY RIFAMPIN. *(E.)* Pessayre, D.; Mazel, P. (Dep. Pharmacol., George Washington Univ., Washington, D.C.). *Fed. Proc.* 34(3):725, 1975.

2657 SELECTIVE INDUCTION OF HEPATIC DRUG METABOLIZING ENZYMES BY LITHIUM TREATMENT IN DOG. *(E.)* Ali, B.; Spencer, H. W.; Auyong, T. K.; Parmar, S. S. (Univ. North Dakota Sch. Med., Grand Forks). *J. Pharm. Pharmacol.* 27(2):131-132, 1975.

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2659 PROTECTION AGAINST CARBON TETRACHLORIDE-INDUCED HEPATOTOXICITY BY PRETREATMENT WITH METHYLMERCURY HYDROXIDE. *(E.)* Carlson, G. P. (Coll. Pharm., Univ. Rhode Island, Kingston). *Toxicology* 4(1):83-89, 1975.

2660 VITAMIN A-STORING CELLS IN PARENCHYMA AND FIBROUS SEPTA IN THE HEPATIC INJURY INDUCED BY CARBON TETRACHLORIDE. *(E.)* Bahu, R. M.; Minick, O. T.; Inouye, T.; Kent, G. (Northwest. Univ. Med. Sch., Chicago, Ill.). *Fed. Proc.* 34(3):844, 1975.

2661 METABOLISM OF ^{14}C-GRISEOFULVIN IN RAT LIVER MICROSOMES, ISOLATED PERFUSED LIVERS AND BILIARY CANNULATED RATS. *(E.)* Lin, C.; Chang, R.; Zampaglione, N. (Dep. Biochem., Schering Corp., Bloomfield, N.J.). *Fed. Proc.* 34(3):785, 1975.

2662 HEPATOCELLULAR HYALIN (MALLORY BODIES) IN LONG TERM GRISEOFULVIN TREATED MICE. *(E.)* Denk, H.; Gschnait, F.; Wolff, K. (Dep. Pharmacol., Univ. Vienna, Austria). *Fed. Proc.* 34(3):843, 1975.

2663 EFFECT OF KETO ACIDS ON METHIONINE METABOLISM BY RAT LIVER HOMOGENATES. *(E.)* Mitchell, A. D.; Benevenga, N. J. (Univ. Wisconsin, Madison). *Fed. Proc.* 34(3):885, 1975.

2664 PHARMACOKINETICS OF AZATHIOPRIN IN ANIMAL EXPERIMENTS AND PATIENTS WITH CHRONIC LIVER DISEASES. *(Ger.)* Bar, U.; Becker, H.; May, B.; Mayer, D.; Ohlendorf, S.; Otto, P.; Schmidt, F. W. (Med. Coll., Hanover, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:943-946, 1973.

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2666 INFLUENCE OF CYCLOLEUCINE ON METABOLISM AND ACUTE EFFECT OF ETHIONINE. *(E.)* Brada, Z.; Novak, M.; Bulba, S.; Penn-Walker, D. (Papanicolaou Cancer Res. Inst., Univ. Miami, Fla.). *Fed. Proc.* 34(3):843, 1975.

2667 THE INFLUENCE OF DIHYDROERGOTAMINE ON THE RESULTS OF INTRAVENOUS PERFUSIONS OF GALACTOSE. *(Fr.)* Charbonnier, A.; Nepveux, P.; Fluteau, G.; Fluteau, D. (Cochin Hosp. Cent., Paris, France). *Ann. Gastroenterol. Hepatol. (Paris)* 10(3): 197-208, 1974.

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See also 2426, 2499, 2545, 2853, 2854, 3477, 3504, 3508, 3557, 3568, 3734, 3759, 3767.

SECRETION AND METABOLISM

Intestine

2784 BILE ACID INHIBITION OF INTESTINAL ANAEROBIC ORGANISMS. *(E.)* Binder, H. J.; Filburn, B.; Floch, M. (Dep. Intern. Med., Yale Univ., New Haven, Conn.). *Am. J. Clin. Nutr.* 28(2): 119-125, 1975.

The inhibitory effect of bile acids on *in vitro* growth of enteric anaerobic organisms was studied in fresh strains of intestinal bacteria isolated from stool cultures. Eleven strains of *Clostridia*, 15 of *Bacteroides*, 13 of *Lactobacillus*, and 12 of gram-negative enteric aerobes were used. The test media consisted of 3 ml each of bile acid or detergent solution and carbohydrate-free thioglycolate broth which was inoculated with an 18-hr broth culture of the test organism. Viable counts were made by quantitatively plating serial dilutions of the test cultures immediately and at 6-, 18-, or 34-hr intervals after the initiation of incubation. Unconjugated bile acids were immediately more effective in controlling the growth of enteric anaerobes than conjugated bile acids; the dihydroxy bile acids, chenodeoxycholic acid and deoxycholic acid, were more inhibitory than the trihydroxy acid, cholic acid. Greater inhibition was observed at pH 6.5 than at pH 7.5 but inhibition was prevented by the addition of lecithin to form mixed micelles. The inhibition by nonbile acid detergents and the failure of a nondetergent bile acid (dehydrocholic acid) to inhibit growth suggests that the mechanism of inhibition is related to the detergent properties of these bile acids. Growth of enteric aerobes was not inhibited by unconjugated bile acids. Although these studies have defined additional characteristics of intestinal anaerobe inhibition by bile acids, such as pH of the media and the presence of mixed micelles, the precise mechanism of this inhibition and potential physiological significance was not clearly established.

2785 THE MOVEMENT OF AN UNEMULSIFIED OIL TEST MEAL AND AQUEOUS- AND OIL-PHASE MARKERS THROUGH THE INTESTINE OF NORMAL AND BILE-DIVERTED RATS. *(E.)* Brand, S. J.; Morgan, R. G. H. (Dep. Physiol., Univ. West. Australia, Nedlands). *Q. J. Exp. Physiol.* 60(1):1-13, 1975.

The effect of bile diversion on gastric emptying and ileocecal transit was investigated by feeding an unemulsified oil test meal containing aqueous- and oil-phase markers (polyethylene glycol and ^{3}H-labeled triether) to control and bile fistula young male albino Wistar rats. Three groups of rats were used: Group I contained 17 internally bile-diverted rats; Group II contained 9 sham-operated animals; and Group III contained 16 control rats. Each rat was fed 0.5 ml of the test meal of unemulsified corn oil containing ^{3}H-labeled triether and ^{14}C-labeled triolein by gavage. The oil was immediately followed by 2 ml of a solution of 1% polyethylene glycol 4000 in 0.15 M NaCl. Rats were killed immediately or 2 or 4 hr after feeding and the gastrointestinal tract removed in 4 segments: stomach, proximal half of small bowel, distal half of small bowel, and cecum plus colon. The recovery of ^{14}C activity, ^{3}H activity (triether) and polyethylene glycol from each segment was calculated and expressed as a percentage of the dose fed. There was a close correlation between the recovery of triglyceride and triether at all levels of emptying, but triether was recovered in slight excess of triolein. There was a lower correlation between the gastric recovery of polyethylene glycol and ^{14}C-triglyceride; polyethylene moved ahead of the lipid

phase in all groups. These results suggest that triether is a valid marker for following the movement of lipid through the bowel under the conditions of this study and that polyethylene glycol is of limited value as a marker. Triether:fat ratios indicated that fat absorption occurred largely from the upper small bowel in control animals and from the lower small bowel in the absence of bile. Bile diversion resulted in more rapid gastric emptying initially, but very slow gastric emptying of the last part of the test meal. Intestinal transit of test meal or either marker was not significantly affected by bile diversion. It is concluded that no evidence was found for a direct effect of bile diversion on gastrointestinal motility.

2786 EFFECT OF GASTROINTESTINAL HORMONES ON THE JEJUNAL AND ILEAL MUCOSA IN MICE AND HAMSTERS: HISTOPHYSIOLOGICAL STUDY. *(Fr.)* Balas, D.; Senegas, F.; Frexinos, J.; Pradayrol, L.; Broussy, J.; Ribet, A. (Purpan Hosp., Paris, France). *Biol. Gastroenterol. (Paris)* 7:187-199, 1974.

After a 48 hr fast, mice and hamsters (mean age 3 months) received single i.p. injections of pentagastrin (3.6 or 12 µg/kg), secretin (1-10 U/kg), histamine (0.1-1 mg/kg), cholecystokinin-pancreozymin (CCK-PZ; 1-10 U/kg), cerulein (0.1-10 µg/kg), or serotonin (5-500 µg/kg) to determine the effects of these hormones on jejunal and ileal mucosa. While pentagastrin, secretin, and histamine had no appreciable effect on Paneth cells in either species, CCK-PZ, cerulein, and serotonin released zymogen granules from Paneth cells. CCK-PZ (doses of 2-3 U/kg) and cerulein (doses larger than 1 µg/kg) decreased the number of zymogen granules in Paneth cells 15-30 min after injection; this decrease was greater in hamsters than in mice. Between 60 and 90 min after injection, the number of zymogen granules increased again to levels above those in controls. While CCK-PZ (doses larger than 5 U/kg) increased the number of basal granules in mast cells in the crypts of Lieberkuhn in mice 30 to 75 min after injection, cerulein did not, even when administered in doses (10 µg/kg) larger than those needed to stimulate pancreatic and biliary secretion. Both CCK-PZ and cerulein stimulated maturation of granules in the Golgi apparatus. When administered in physiological doses, serotonin had no effect on Paneth cells, but at almost lethal doses (500 µg/kg) zymogen granules were rapidly released in both mice and hamsters. However, attempts to produce degranulation of Paneth cells *in vitro* with serotonin (10^{-6} to 1 mg/liter) were unsuccessful. Although these findings suggest that CCK-PZ and cerulein stimulate synthesis by increasing synthesis of granules in the Golgi apparatus, it cannot be ruled out that they act indirectly by stimulating production of pancreatic enzymes or bile. Large doses of serotonin may release zymogen granules by activating vagal centers; by producing a vagal effect locally by inhibiting cholinesterase, thus increasing accumulation of acetylcholine; and by increasing the frequency and amplitude of peristaltic activity, thus favoring the emptying and evacuation of secretion from intestinal glands.

2787 STIMULATION OF PROTEOLYTIC DIGESTION BY INTESTINAL GOBLET CELL MUCUS. *(E.)* Shora, W.; Forstner, G. G.; Forstner, J. F. (Hosp. Sick Child., Univ. Toronto, Canada). *Gastroenterology* 68(3):470-479, 1975.

Intestinal goblet cell mucus from rat small intestine was added to incubations of casein and trypsin (or chymotrypsin) to determine whether mucus could inhibit proteolysis. Hydrolysis of α-casein by trypsin was used as a standard assay in the study. Goblet cell mucus stimulated casein hydrolysis, reaching a maximum effect at a mucus to casein ratio (w/w) of 0.083. Goblet cell mucus did not contain proteolytic enzymes or proenzymes as contaminants, nor did it serve as a substrate for trypsin. Stimulation was not reduced by removing 85% of the sialic acid from the goblet cell mucus. Pretreatment of casein by boiling and freezing decreased (50%) the goblet cell mucus effect, as did partial predigestion of casein by trypsin, and increasing trypsin concentration above 3 µg/ml. Goblet cell mucus also enhanced the hydrolysis by trypsin of intestinal brush border membrane protein, but had no effect on the hydrolysis of hemoglobin, albumin, or benzoyl arginine ethyl ester. It is suggested that goblet cell mucus interacts only with certain substrates (not the enzyme) to produce enhancement of trypsin hydrolysis.

2788 HYPERSENSITIVITY REACTIONS IN THE SMALL INTESTINE. I. THYMUS DEPENDENCE OF EXPERIMENTAL 'PARTIAL VILLOUS ATROPHY'. *(E.)* Ferguson, A.; Jarrett, E. E. E. (West. Infirm., Glasgow, Scotland). *Gut* 16(2):115-117, 1975.

Small intestinal morphology was studied in thymus-deprived rats infected with *Nippostrongylus brasiliensis* to determine if the mechanism causing morphological changes could be immunological. Thymus-deprived Lister rats received whole-body irradiation and were infected between 1 and 3 months later with a s.c. injection of 4000 *N. brasiliensis* larvae. Six to 20 weeks after infection the animals were killed and sections of small intestine were prepared for histological study including measurements of villus height and crypt depth. Normal rats infected with *N. brasiliensis* showed crypt hyperplasia with villous atrophy in affected areas of the small intestine. In the thymus-deprived rats, the course of infection was prolonged, but the morphology appeared essentially normal in 70% of those animals. The findings suggest that the tissue damage associated with the *N. brasiliensis* infection is caused by a thymus-dependent immune reaction in the small intestine, and is not due simply to the toxic effects of the nematode.

2789 A ONE-STEP L-AMINO ACID OXIDASE ASSAY FOR INTESTINAL PEPTIDE HYDROLASE ACTIVITY. *(E.)* Nicholson, J. A.; Kim, Y. S. (VA Hosp., San Francisco, Calif.). *Anal. Biochem.* 63(1):110-117, 1974.

A rapid 1-step assay for intestinal peptide hydrolase activity in mucosal homogenates, and in cytosol and particulate fractions prepared from homogenates has been developed. Mucosa from the proximal small intestine of male Wistar rats was used as the source of enzyme. Peptide hydrolysis, and estimation of liberated L-amino acids by use of L-amino acid oxidase, peroxidase, and a chromogen was achieved by a single incubation step. Each peptide was dissolved in 0.5 ml of 50 mM Tris-HCl, pH 8.0, and 1 ml of L-amino acid oxidase reagent (20 mg of L-amino acid oxidase, 2 mg of horseradish peroxidase, and 10 mg of *o*-dianisidine dissolved in 100 ml of Tris-HCl buffer pH 8.0) was added to these solutions. Tubes containing dipeptide substrate and L-amino acid oxidase reagent were maintained at 37 C and 25 µl of enzyme preparation was added. The reaction was stopped after a timed interval by addition of 0.74 ml 50% sulfuric acid, this amount giving optimal color development. Absorbance of the purple color was measured at 530 nm. The most suitable peptide substrates are dipeptides composed of 1 which does not react. Brush border peptide hydrolase activity may also be estimated with this assay by performing the incubation in the presence of *p*-hydroxymercuribenzoate. It is concluded that this method is simpler to perform than previously described 2-step methods and is especially useful in analyses of large numbers of samples.

2790 BILE SALT ALTERATION OF COLONIC ELECTROLYTE TRANSPORT: ROLE OF CYCLIC ADENOSINE MONOPHOSPHATE. *(E.)* Binder, H. J.; Filburn, C.; Volpe, B. T. (Dep. Intern. Med., Yale Univ., New Haven, Conn.) *Gastroenterology* 68(3):503-508, 1975.

The effect of bile salts on mucosal cyclic AMP (cAMP) levels and the effect of cAMP on ion transport were studied in rats. The cAMP content of the colonic mucosa of Sprague-Dawley rats was determined in two separate series of experiments during which mucosa was exposed to different bile salts under both *in vivo* and *in vitro* conditions. Colonic mucosal cAMP levels in the rat increased by 54% after *in vivo* incubation with taurochenodeoxycholic acid. Taurocholic acid, which neither induced fluid secretion nor increased short circuit current at concentrations at which taurochenodeoxycholic acid increased both, did not alter mucosal cAMP. Dibutyryl cAMP decreased net sodium absorption and increased short circuit current, findings which were qualitatively identical to those produced by taurochenodeoxycholic acid. These observations support the proposal that bile salts stimulate colonic electrolyte secretion by increasing mucosal cyclic AMP.

2791 RELATIONS OF WEAK-ELECTROLYTE TRANSPORT AND ACID-BASE METABOLISM IN RAT SMALL INTESTINE IN VITRO. *(E.)* Jackson, M. J.; Morgan, B. N. (George Washington Univ. Med. Cent., Washington, D.C.). *Am. J. Physiol.* 228(2):482-487, 1975.

The relations between the intestinal transport of weak electrolytes and the pattern of acid-base metabolism were studied in the rat small intestine *in vitro*. Tissue was taken from the jejunum and ileum of Wistar rats and used in two types of chamber preparations, one for the determination of weak-electrolyte fluxes and the other for studies of acid-base metabolism. Weak-electrolyte fluxes were estimated by the addition of 1mM benzoic acid or benzylamine to the incubation saline (kept at pH 7.3) and 0.5 µCi of ^{14}C-labeled tracer to one reservoir. The procedure used in the acid-base metabolism studies involved observation of pH changes in the mucosal and serosal fluids of the chamber system. The jejunal pattern of weak-electrolyte transport was net transport of weak acids from mucosal to serosal and of weak bases from serosal to mucosal; the pattern of acid-base metabolism was luminal acidification and serosal alkalinization. In the absence of sodium or in the presence of metabolic inhibitors, weak-electrolyte transport and serosal alkalinization were inhibited, but luminal acidification was not inhibited. The ileal pattern of weak-electrolyte transport was opposite that of the jejunum and could be associated with the presence of a luminal alkalinization process observed in that region. In the absence of chloride, the patterns observed in the ileum and jejunum were similar. The results confirm previous suggestions that the mechanisms for intestinal transport of weak electrolytes are related to asymmetries in the acid-base metabolism of the tissue.

2792 INTESTINAL LYMPH FORMATION AND FAT ABSORPTION: STIMULATION BY ACUTE ETHANOL ADMINISTRATION AND INHIBITION BY CHRONIC ETHANOL FEEDING. *(E.)* Baraona, E.; Lieber, C. S. (VA Hosp., Bronx, N.Y.). *Gastroenterology* 68(3):495-502, 1975.

The effects of both acute and chronic ethanol administration on the transport of dietary lipids into the lymph were studied in rats. To study the chronic effects of ethanol, rats were pair-fed liquid diets containing either ethanol (36% of calories) or isocaloric carbohydrate (control diet) for 3-4 weeks. The superior mesenteric lymph duct was cannulated and the accessory intestinal lymphatics were ligated. The acute effects of ethanol were assessed by comparing the response of the same animal to the randomized administration of ethanol, either in lipid emulsions administered intraduodenally or in liquid diets given by gastric tube. The acute administration of ethanol increased the flow of intestinal lymph and the output of proteins and dietary lipids into the lymph, primarily in the first hr after administration. During that time, the intraduodenal administration of ethanol (0.75 g/kg) without exogenous lipids increased the flow of lymph without changing the lymph lipid output. Stimulation of the lymph flow with neostigmine or by increasing the fluid load also enhanced the output of lymph proteins and the transport of exogenous lipids from the intestinal lumen into the lymph. The administration of an acute ethanol dose to rats chronically fed alcohol moderately increased the lymph flow but did not change the output of dietary lipids. Rats chronically fed alcohol responded to a dietary chal-

lenge devoid of ethanol with increases in both lymph flow and dietary lipid output, but the responses were smaller than in controls. The findings suggest that alcohol drinking may favor fat absorption temporarily, but the effect would tend to be abolished by prolonged ingestion of alcohol.

2793 PYRIMIDINE BIOSYNTHETIC ENZYMES IN RAT INTESTINE AFTER SMALL BOWEL RESECTION. *(E.)* Nakayama, H.; Weser, E. (Univ. Texas Med. Sch., San Antonio). *Gastroenterology* 68(3):480-487, 1975.

Activities of the enzymes of pyrimidine biosynthesis were studied in rat intestine remaining after small bowel resection. Male Sprague-Dawley rats underwent resection of 50 cm of proximal or distal intestine or sham operation. At 1 and 6 months after surgery, aspartate transcarbamylase, dihydroorotase, and uridine kinase were assayed in whole mucosa and in crypt mucosa from the remaining intestinal segment. Determination of [^{3}H]thymidine incorporation into DNA was made 5 weeks after distal resection. In control bowel, enzyme activity was significantly greater in proximal compared with distal segments. One month after proximal or distal resection, mucosal weight and mucosal enzyme activity/cm of gut were greater in the remnant bowel compared with controls. There were no such differences at 6 months. Specific enzyme activity (including thymidine kinase) of isolated crypt mucosa was significantly increased 1 month after distal resection. In addition, [^{3}H]thymidine uptake into DNA of crypt mucosa from proximal remnants was also significantly increased. After small bowel resection, mucosal hyperplasia and an increase in nucleic acid synthesis and cell proliferation occur in the remaining segment, and the results indicate that the enzymes of pyrimidine biosynthesis also increase in the remaining bowel and parallel the accelerated rate of cell proliferation.

2794 DEOXYCHOLATE DEPRESSES SMALL-INTESTINE ENZYME ACTIVITY. *(E.)* Gracey, M.; Houghton, M.; Thomas, J. (Princess Margaret Child. Med. Res. Found., Perth, Australia). *Gut* 16(1):53-56, 1975.

The effect of the deconjugated bile salt, sodium deoxycholate, on the activity of several small-intestine enzymes was studied in rats. Wistar rats were fed 25 mg sodium deoxycholate in their diet for 4 days; enzyme assays were done at 24-hr intervals following the bile salt feeding period. Oral administration of sodium deoxycholate caused depression of the activity of the small intestinal enzymes lactase, sucrase, maltase, alkaline phosphatase, and N-acetyl-β-glucosaminidase (a lysosomal enzyme). Alkaline phosphatase activity recovered rapidly and rose to above normal level within 24 hr after the animals resumed a normal diet. The activity of the three disaccharidases returned to normal within 7 days; there was no evidence of recovery of N-acetyl-β-glucosaminidase activity after 4 days of normal diet, and the degree of depression remained highly significant. The results show that sodium deoxycholate, when present in the lumen of the upper gut in excessive concentrations, may have harmful effects on intestinal digestive exzymes.

2795 MECHANISMS OF LIPID LOSS FROM THE SMALL INTESTINAL MUCOSA. *(E.)* Waldram, R. (St. Thomas' Hosp., London, England). *Gut* 16(2):118-124, 1975.

Loss of lipids from the small intestinal mucosa was investigated by perfusion experiments in rats to show whether the loss is related to lipid solubility in the perfusion fluid. Wistar rats were prepared with a polyethylene cannula inserted into the small bowel. Perfusion fluids were 0.15 M NaCl/liter phosphate or glycine buffer solutions at pH 3.7, 5.4, and 9.7, with or without the addition of 5.7 or 11.4 mM taurocholic acid. Perfusates were extracted for estimation of DNA and for individual lipids (separated by thin-layer chromatography). No significant change in amounts of DNA or lipids was observed with time, with the exception of significantly more phosphatidyl choline in the first 11.4 mM taurocholic acid perfusion than in subsequent perfusates. Nor was there any significant difference in amounts of lipids or DNA in perfusates from fasted animals and those not fasted. Amounts of fatty acids were not related to DNA in any perfusion solution. The lipid compositions of mucosal cell suspensions and saline perfusates were found to be similar, except for fatty acids, which were found to be 18 times greater in the perfusates than in cell suspensions. The results suggest that free fatty acids reach the lumen by diffusion, that their solubility in the luminal fluid is a factor determining their rate of loss, and that triglycerides, cholesterol, phosphatidyl ethanolamine, and phosphatidyl choline are present only as the result of desquamation of mucosal cells.

2796 INTESTINAL METABOLISM OF PLASMA FREE FATTY ACIDS: INTRACELLULAR COMPARTMENTATION AND MECHANISMS OF CONTROL. *(E.)* Gangl, A.; Ockner, R. K. (Univ. California Sch. Med., San Francisco). *J. Clin. Invest.* 55(4):803-813, 1975.

The metabolism of plasma free fatty acids in the intestinal mucosa of rats was investigated with particular regard to lipid absorption. [^{14}C]palmitic acid-rat serum complex was injected i.v. into Sprague-Dawley rats. Blood was collected at specified time intervals and the small intestine removed and prepared for analysis. Mucosal radioactivity was maximal 2 min after i.v. [^{14}C]palmitate. Of mucosal ^{14}C, 42% was in water-soluble metabolites, 28% in phospholipids, and 16% in triglycerides. The specific activity of mucosal triglyceride fatty acids was 11 times those of the serum, confirming *in situ* synthesis. Luminal fatty acids entering mucosa were chiefly esterified to triglycerides, while plasma free fatty acids were oxidized and incorporated into phospholipids. Mucosal metabolism of i.v. [^{14}C]palmitate was minimally affected by glu-

cose administration; intraduodenal isocaloric ethanol inhibited mucosal oxidation of free fatty acids by 60% and nearly doubled their incorporation into triglycerides. During lipid absorption, mucosal uptake of plasma free fatty acids doubled and incorporation into intestinal lymph triglycerides was increased sixfold. Since similar activity was observed in both villi and crypts, it is suggested that the compartmentation of fatty acids is intracellular, that their metabolism in the epithelial cell appears to be determined by their site of entry into the cell, and in the fasting state plasma free fatty acids are both an energy source and a substrate for the synthesis of tissue phospholipid.

2797 CELLULAR ENZYMOLOGY OF THE HUMAN FOETAL INTESTINE. *(Fr.)* Tabbara, R.; Wegmenn, R. (French Fac. Med. Pharm., Beirut, Lebanon). *Ann. Histochim.* 19(1):77-83, 1974.

The activities of 32 enzymes were studied in the duodenum and jejunum of 4 human embryos, aged approximately 4 to 7.5 months. The activities of most enzymes were low at 4 months and increased with age. The exceptions were NADPH-tetrazolium reductase, lactate dehydrogenase, and peptidases which were highly active at 4 months, subsequently decreased, and later reached or exceeded their previous levels. Nucleic acids were present in large quantities throughout. However, at 4 months, no cell desquamation had occurred and nucleic acids were found in cells of the epithelium and chorion. After 7 months, desquamation was observed and meconium formed which contained large amounts of RNA and DNA. In general, metabolic activity was much lower in the chorion than in the epithelium. While variations in the activities of glucose-6-phosphatase, fructose-1,6-diphosphatase, lactate dehydrogenase, and glutamate dehydrogenase occurred in the epithelium, these variations were not found in the chorion.

2798 INFLUENCE OF SECRETIN AND CHOLECYSTOKININ ON MALTASE, SUCRASE AND LACTASE IN THE JEJUNUM OF THE RAT. *(E.)* Rommel, K.; Bohmer, R. (Dep. Clin. Chem., Univ. Ulm, Germany). *Digestion* 11(3/4): 194-198, 1974.

The activities of maltase, sucrase, and lactase were studied in rat intestinal mucosa, after injection of secretin or cholecystokinin. Wistar rats were fasted 12 hr and given either 1.5 U secretin or cholecystokinen i.v. Controls were given an equivalent volume of 0.9% saline. A segment of small intestine 20-40 cm from the pylorus was removed, the mucosa scraped off and the maltase, sucrase, and lactase activities determined. Maltase activity after secretin injection was 484.2 IU/mg protein as compared to a control value of 258.2 IU/mg protein. Sucrase activity was likewise raised from 62.1 to 121.5 IU/mg protein, while lactase activity was unaffected. Cholecystokinin caused no changes in any of the enzyme activities studied. It is concluded that there is a direct or indirect effect of secretin on synthesis or activation of maltase and sucrase.

2799 ANIMAL EXPERIMENTS ON METABOLIC CHANGES AND FECAL BILE ACID EXCRETION AFTER ILEAL RESECTION. *(Ger.)* Merkle, P.; Hartung, H.; Merkle, N.; Maurer, M. (Surg. Clin., Univ. Freiburg, Germany). *Bruns Beitr. Klin. Chir.* 221(8):638-642, 1974.

The distal half of the small intestine was resected, and a side-to-side anastomosis was made between the proximal stump of the small intestine and the cecum in 10 male and female rabbits. Blood samples were taken before surgery and at 2 week intervals thereafter for determination of Na^+, K^+, total protein, cholesterol, and triglyceride concentrations. Bile acid concentrations were determined on feces collected at the same times. Following administration of ^{131}I-labeled triolein, triglyceride absorption was measured 8 weeks after surgery. Serum electrolyte levels and triglyceride absorption remained unchanged after surgery, but serum triglyceride levels decreased slightly and cholesterol values by 50% 2-8 weeks after surgery. No change occurred in fecal bile acid excretion or in the consistency of the stools after surgery. These changes which differ greatly from those found in humans who have undergone ileectomy or who have ileal disease, indicate that resection of the distal small intestine in the rabbit does not increase bile acid synthesis or reabsorption. The decrease in serum cholesterol levels after enterectomy is attributed to decreases in cholesterol synthesis and absorption which normally occur in the small intestine.

2800 THE MORPHOLOGY AND ENZYME ACTIVITIES IN RAT SMALL INTESTINE DURING ORAL ADMINISTRATION OF NEOMYCIN AND GLIADIN-FREE AND GLIADIN-CONTAINING DIETS. *(Ger.)* Lucking, T. (Pediatr. Clin., Univ. Hamburg, Germany). *Z. Gastroenterol.* 13(2):362-367, 1975.

Of 40 male Wistar rats, 20 received a synthetic diet containing 5% gliadin, 15% casein, 65% sucrose, 15% corn oil, and a vitamin and mineral supplement while the remaining 20 were given a gliadin-free diet containing 20% casein. Starting 8 days later, 10 rats in each group received 12 mg/ml neomycin sulfate in their drinking water. After a 12 hr fast, rats were sacrificed 21 days later. All animals lost weight during the experiment. Those receiving neomycin lost more weight than controls, even those that also received gliadin. Neomycin-treated rats, both those given gliadin-free and gliadin-containing diets, showed much less spontaneous activity after 2 weeks of treatment than the controls. They ate and drank less so that their mean weights decreased from 150 g to 94.5 g in the group receiving gliadin and to 87.1 g in the group receiving the gliadin-free diet. Examination of the mucosa of the small intestine under a stereomicroscope showed no morphological differences between these four groups of rats. The activities of

lactase, sucrase, maltase, glycyl-L-leucine dipeptidase, L-alanyl-L-leucine dipeptidase, acid and alkaline phosphatase, and β-glucuronidase, determined on supernatants from homogenized mucosa from the small intestine, were the same in all four groups of rats. From these results it is concluded that neomycin has some kind of toxic effect on rats although it causes no morphological or enzymatic changes in the small intestine.

2801 CHANGES IN DISACCHARIDASE ACTIVITIES IN THE SMALL INTESTINAL MUCOSA OF THE RAT AFTER A SINGLE DOSE OF 5-FLUOROURACIL. *(Ger.)* Mielke, F. (Charlottenburg Clin., Berlin, Germany). *Z. Gastroenterol.* 13(2):356-361, 1975.

A single dose of 40 mg 5-fluorouracil was injected i.p. into 70 female Wistar rats which were then sacrificed in groups of 10 each 24 to 168 hr later. This dose is 3 times that used therapeutically. Untreated rats served as controls. All animals were fasted for 24 hr before sacrifice. No gross morphological changes were found in the small intestine following administration of 5-fluorouracil. Disaccharidase activities, determined on homogenates of mucosa from the small intestine, were decreased after 48 hr: maltase activities by 13%, trehalase by 59%, lactase by 52%, and cellobiase by 61%. Except for maltase activities which reached a minimum 60 hr after injection, disaccharidase activities were lowest after 72 hr. At this time maltase activities were decreased by 40%, trehalase by 75%, lactase by 87%, and cellobiase by 94%. A significant increase in the activities of all enzymes occurred after 96 hr, but increased became more gradual thereafter. Even after 7 days, none of the enzymes had reached their initial levels. Maltase and trehalase activities were 4% and 10%, resp., below control values, while lactase and cellobiase were 26% and 28%, resp., lower. These findings, which agree with others in the literature, suggest that the first cell population covering the villi 96 hr after administration of 5-fluorouracil are not functionally mature. Absorption and digestion have almost normalized by the time the next cell population reaches the ends of the villi.

2802 THE INTESTINAL CELL: FINDINGS ON ITS MORPHOLOGY AND METABOLIC FUNCTIONS. CHANGES DURING ISCHEMIA AND EXPERIMENTAL VENOUS STASIS. *(Fr.)* Cougard, A.; Chamlian, A.; Minges, H. (no affil.). *Ann. Anesthesiol. Fr.* 15(Suppl. 1):1-13, 1974.

2803 CYTOMORPHOLOGICAL AND ENZYME-HISTOCHEMICAL ASPECTS OF THE INTESTINAL MUCOSA IN COMPLETE STARVATION. *(Ger.)* Schafer, A.; Hohn, P.; Gabbert, H.; Paasch, W. (Pathol. Inst., Univ. Mainz, Germany). *Verh. Dtsch. Ges. Pathol.* 57:389, 1973.

2804 THE RELATIONSHIP BETWEEN THE INTESTINAL RELEASE OF LYSOMAL ENZYMES AND CARDIOTOXIC MATERIAL DURING REGIONAL SIMULATED SHOCK: AN EXPERIMENTAL STUDY IN THE CAT. *(E.)* Haglund, U.; Lundholm, K.; Lundgren, O.; Schersten, T. (Dep. Surg. II, Univ. Goteberg, Sweden). *Circ. Shock.* 2 (1):49-56, 1975.

2805 SPECIFICITY OF THE ACTION OF PHOSPHOLIPASES FROM RAT INTESTINAL MUCOSA. *(Fr.)* Bonnefis, M. J.; Lloveras, J.; Douste-Blazy, L. (Purpan Hosp., Toulouse, France). *C. R. Acad. Sci. [D] (Paris)* 280(5):661-664, 1975.

2806 INHIBITION BY OXOTREMORINE OF ACETYLCHOLINE RESTING RELEASE FROM GUINEA PIG-ILEUM LONGITUDINAL MUSCLE STRIPS. *(E.)* Kilbinger, H.; Wagner, P. (Pharmacol. Inst., Univ. Mainz, Germany). *Naunyn Schmiedebergs Arch. Pharmacol.* 287(1):47-60.

2807 METABOLISM OF RECTOCOLONICALLY ADMINISTERED, SATURATED TRIGLYCERIDES IN THE COURSE OF CHRONIC ABSORPTION TESTS IN THE RABBIT. *(Fr.)* Bacques, C.; Dorier, A. (Lab. Physiol., I. U. T., Lyon, France). *J Physiol.* (Paris) 69(Suppl):138A, 1974.

2808 BIOSYNTHESIS AND DEGRADATION OF METHYLMERCURY IN HUMAN FAECES. *(E.)* Peaker, M.; Linzell, J. L. (ARC Inst. Anim. Physiol., Cambridge, England). *Nature* 253(5491):462-464, 1975.

2809 CONTINENT COLOSTOMY: AN EXPERIMENTAL STUDY IN DOGS. *(E.)* Kock, N. G.; Geroulanos, S.; Hahnloser, P.; Schauwecker, H.; Sauberli, H. (Canton. Hosp., Zurich, Switzerland). *Dis. Colon Rectum* 17(6):727-734, 1974.

2810 ROLE OF LYSOSOMES IN CARRAGEENAN-INDUCED CECAL ULCERATION. *(E.)* Abraham, R.; Fabian, R. J.; Golberg, L.; Coulston, F. (Albany Med. Coll., N.Y.). *Gastroenterology* 67(6):1169-1181, 1974.

2811 ENERGY ROLE OF DIETARY CARBOHYDRATES IN THE INTESTINAL EPITHELIUM: PROSPECTS FOR MICROCALORIMETRIC STUDIES. *(Ger.)* Hellauer, H.; Winkler, R. (no affil.). *Zuckerforsch. Inst.* 107-108, 1973/74.

2812 LACTASE ACTIVITY OF THE MUCOSA OF THE SMALL INTESTINE IN DOGS WITH EXPERIMENTAL PANCREATITIS. *(Ukr.)* Levytskyi, A. P.; Redchits, P. S. (Odessa Med. Inst., USSR). *Fiziol. Zh.* 20(6): 823-824, 1974.

2813 THE SPECIFICITY OF ENZYME SECRETION IN THE INTESTINE. *(Fr.)* Roduner, J.; Honegger, J.; Hesford, F.; Hadorn, B. (Univ. Pediatr. Hosp., Bern, Switzerland). *Biol. Gastroenterol. (Paris)* 7(4):301, 1974.

2814 THE DETERMINATION OF LACTASE, MALTASE AND ALKALINE PHASPHATASE ACTIVITY IN THE SMALL INTESTINAL MUCOSA OF HEALTHY PEOPLE. *(Rus.)* Bobkova, E. D.; Iuschuk, N. D.; Shalygina, N. B. (Cent. Sci. Res. Inst. Epidemiol., Moscow, USSR). *Lab. Delo* (3):160-162, 1975.

2815 DISACCHARIDASE ACTIVITY IN THE SMALL INTESTINE OF ADULTS. *(Ger.)* Madzarovova-Nohejlova, J. (1st Med. Clin., Charles Univ., Plzen, Czechoslovakia). *Dtsch. Z. Verdau. Stoffwechselkr.* 34(2-4):229-231, 1974.

2816 DIGESTIVE ENZYMES IN THE SMALL INTESTINE AND PANCREAS OF GERM-FREE ANIMALS. *(Ger.)* Malis, F.; Fric, P.; Lojda, Z.; Stepankova, R.; Kruml, J. (Med. Fac., Charles Univ., Prague, Czechoslavakia). *Dtsch. Z. Verdau. Stoffwechselkr.* 34(2-4): 225-228, 1974.

2817 EFFECT OF SECRETIN AND CHOLECYSTOKININ-PANCREOZYMIN ON INTESTINAL DISACCHARIDASES AND MONOSACCHARIDE ABSORPTION IN THE RAT. *(Ger.)* Bohmer, R.; Rommel, K.; Welter, D. (Inst. Clin. Chem., Univ. Ulm, Germany). *Z. Gastroenterol.* 12 (Suppl.):427-428, 1974.

2818 ENZYME CYTOCHEMISTRY OF THE HUMAN SMALL INTESTINAL MUCOSA UNDER NORMAL AND PATHOLOGICAL CONDITIONS. *(Ger.)* Riecken, E. O. (Med. Clin., Univ. Marburg/Lahn, Germany). *Z. Gastroenterol.* 13(Suppl.):210-222, 1975.

2819 THE DIGESTIVE AND ABSORPTION FUNCTIONS OF SMALL INTESTINAL MUCOSA. *(Ger.)* Caspary, W. F. (Med. Clin., Univ. Gottingen, Germany). *Z. Gastroenterol.* 13(Suppl.):223-243, 1975.

2820 EFFECT OF CERULEIN ON ENZYME SECRETION IN THE ISOLATED SMALL INTESTINE OF THE RAT. *(Fr.)* Vaultier, J. P.; Mirhom, R.; Eloy, R.; Vasseur, M.; Jaeck, D.; Grenier, J. F. (INSERM Unit 61, Strasbourg-Hautepierre, France). *Biol. Gastroenterol. (Paris)* 7(4):303-304, 1974.

2821 EFFECT OF GASTROINTESTINAL HORMONES ON AMYLASE ACTIVITY IN INTESTINAL JUICE IN THE HAMSTER. *(Fr.)* Senegas, F.; Balas, D.; Ribet, A. (Purpan Hosp., Toulouse, France). *Biol. Gastroenterol. (Paris)* 7(4):302-303, 1974.

2822 STUDY OF INTESTINAL AMYLASE IN THE HAMSTER: COMPARISON WITH SALIVARY AND PANCREATIC AMYLASE. *(Fr.)* Laval, J.; Pradayrol, L.; Balas, D.; Ribet, A. (Purpan Hosp., Toulouse, France). *Biol. Gastroenterol. (Paris)* 7(4):302, 1974.

2823 INTESTINAL CALCIUM-BINDING PROTEIN IN ANIMALS FED NORMAL AND RACHITOGENIC DIETS: I. RAT STUDIES. *(E.)* Harrison, J. E.; Hitchman, A. J. W.; Tam, C. S. (Dep. Med., Univ. Toronto, Canada). *Can. J. Physiol. Pharmacol.* 53(1):137-143, 1975.

2824 ACID HYDROLASES IN THE SUCKLING RAT SMALL INTESTINE. II. ON THE IMPORTANCE OF ALKALINE PHOSPHATASE INHIBITION IN THE HISTOCHEMICAL LOCALIZATION OF ACID PHOSPHATASE ACTIVITY. *(E.)* Connock, M. J.; Sturdee, A. P. (Dep. Biol. Sci., Polytech., Wolverhampton, England). *Histochem. J.* 7(2):103-114, 1975.

2825 THE DEMONSTRATION OF O-ACETYLATED SIALIC ACIDS IN COLONIC EPITHELIAL GLYCOPROTEINS. *(E.)* Reid, P. E.; Culling, C. F. A.; Tsang, W. C.; Clay, M. C.; Ramey, C. W.; Dunn, W. L. (Fac. Med., Univ. British Columbia, Vancouver, Canada). *Can. J. Biochem.* 53(3):388-391, 1975.

2826 EVIDENCE FOR THE ROLE OF 1,25-DIHYDROXY-CHOLECALCIFEROL (1,25-DHCC) IN ACUTE LOW CALCIUM ADAPTATION. *(E.)* Pento, I. T.; Badeen, R. L. (Dep. Pharmacol., Univ. Oklahoma, Norman). *Fed. Proc.* 34(3):894, 1975.

2827 EFFECT OF QUALITY AND QUANTITY OF DIETARY FAT ON SENSITIVITY OF COLON TO CARCINOGENIC EFFECT OF 1,2-DIMETHYLHYDRAZINE IN RATS. *(E.)* Reddy, B. S.; Narisawa, T.; Vukusich, D.; Mangat, S.; Wynder, E. L.; Weisburger, J. H. (Am. Health Found., New York, N.Y.). *Fed. Proc.* 34(3):900, 1975.

2828 QUANTITATION OF TRYPTOPHAN METABOLITES IN RAT FECES BY THIN-LAYER CHROMATOGRAPHY. *(E.)* Anderson, G. M. (Natl. Cancer Inst., Frederick Can. Res. Cent., Md.). *J. Chromatogr.* 105(2):323-328, 1975.

2829 GLUCURONIDATION OF 1-NAPTHOL IN THE RAT INTESTINAL LOOP. *(E.)* Bock, K. W.; Winne, D. (Inst. Toxicol., Tubingen, Germany). *Biochem. Pharmacol.* 24(8):859-862, 1975.

2830 ENDOTOXIN AND PRODUCTION OF PROSTAGLANDINS BY THE ISOLATED RABBIT JEJUNUM. INFLUENCE OF INDOMETHACIN. *(E.)* Herman, A. G.; Vane, J. R. (R. Coll. Surg. England, London). *Arch. Int. Pharmacodyn. Ther.* 213(2):328-329, 1975.

See also, 2430, 2505, 2654, 2717, 2728, 2838, 3020, 3758.

2831 RADIOMETRIC ESTIMATION OF THE AMOUNT OF SOLID GASTROINTESTINAL CONTENTS. *(E.)* Pfau, A.; Abadir, F. A. (Inst. Anim. Husb. Anim. Behavior, Mariensee, Germany). *Experientia* 30(11): 1296-1298, 1974.

The estimation of solid gastrointestinal contents by dilution techniques using radioactive markers was investigated in 12 78-week-old bulls. ^{152}Eu was used as the marker of the solid phase and ^{14}C-polyethyleneglycol (PEG) as marker of the liquid phase. The markers were administered in aqueous solutions *via* stomach tube or rumen fistula. Except for ^{14}C-PEG in ruminal fluid, all the other turnover rate constants for ^{152}Eu and ^{14}C-PEG in rumen or feces appeared to be almost identical. The solid phase in cattle gastrointestinal tract, therefore, could be described with a one-compartment model but at least two components are necessary to describe the fluid phase. These findings led to the conclusion that it is justified to use the ^{152}Eu fecal excretion measurements for determining the turnover rate of the ruminal solid phase even if other factors indicated different compartments to be assayed by fecal and ruminal estimates. Values obtained by this procedure *in vivo* demonstrated good agreement with gravimetric measurements after slaughter. The amount of dry matter in the intestine corresponded fairly well to the values from radiometric measurements on healthy bulls. It is suggested that ^{152}Eu dilution analysis might be of use for the estimation of the amount of solid contents in the intestine. However, without further measurements or assumptions, the wet content of the rumen or gastrointestinal tract cannot be obtained with this technique.

2832 EFFECT OF EXPOSURE TO HYPEROXIC, HYPOBARIC, AND HYPERBARIC ENVIRONMENTS ON CONCENTRATIONS OF SELECTED AEROBIC AND ANAEROBIC FECAL FLORA OF MICE. *(E.)* Gillmore, J. D.; Gordon, F. B. (Nav. Med. Res. Inst., Bethesda, Md.). *Appl. Microbiol.* 29(3):358-367, 1975.

Alterations in selected aerobic and anaerobic fecal microflora of the mouse were determined during exposure to hyperoxic and normoxic hypo- and hyperbaric environments. Examination of fecal cultures obtained during exposure of female NMRI Swiss mice for 6 weeks to 60 or 77% oxygen concentration at 1 atmosphere absolute revealed little alteration in the aerobic or anaerobic flora. There appeared to be only a retardation in the reduction of the *Klebsiella-Enterobacter* flora which normally occurs after weaning. During exposure to hypobaric environments (100% O_2, 0.2 atmosphere absolute), significant alteration (increases) in the concentrations of *Escherichia coli*, slow lactose fermenters, *Klebsiella-Enterobacter*, and enterococci were found in some instances. Variations in the concentrations of different colony types of obligately anaerobic gram-positive and gram-negative rods cultured during the same experiments also occurred. One colony type of gram-positive rods appeared to decrease, while a second type increased. The concentrations of three colony types of gram-negative rods were generally, but not always, increased. During hyperbaric exposure (2.8% O_2, 7.5 atmospheres absolute), increased concentrations of *Klebsiella-Enterobacter*, *E. coli*, slow lactose fermenters, and enterococci were noted. Changes in the numbers of both colony types of gram-positive rods, when occurring, were in the direction of lower numbers. Alterations in the numbers of gram-negative rods were in both directions but were more frequently in the direction of higher numbers. After return to normal air following 4 weeks of hypo- or hyperbaric exposure, the fecal concentrations of most organisms tended to revert toward control values; the gram-positive rods, however, remained in reduced concentrations. These data indicate that, despite the great variation in the fecal flora among individual mice, it is possible to discover the effects induced by altered gaseous environments.

2833 MECHANISM OF BLOODY DIARRHEA IN SHOCK. *(E.)* Crowell, J. W.; Nelson, Jr., K. M. (Univ. Mississippi Med. Cent., Jackson). *Circ. Shock* 2(1):21-28, 1975.

Ink was injected i.v. into anesthetized adult mongrel dogs to study the effect of shock on liver microcirculation. Prior to ink injection, the animals were subjected to hemorrhagic shock, hemorrhagic shock and hepatic artery occlusion, hepatic vein occlusion, or hepatic vein occlusion and portal diversion. In 10 normal control dogs, ink was evident after 3 hr from the triad to the central vein of the liver, although it was most dense in the triad area. After irreversible hemorrhagic shock, ink was still evident in the triad area but none was evident in the central vein area. Occlusion of the hepatic vein with the portal blood diverted into the femoral vein caused an ink pattern similar to that seen after hemorrhagic shock. Ligation of the hepatic artery after hemorrhagic shock resulted in a total absence of ink in large areas of the liver, with other areas showing ink in the same pattern observed in the controls. Hepatic vein occlusion without hemorrhagic shock resulted in an ink pattern similar to that seen in controls, but the ink was less dense. In the latter group, the liver was greatly enlarged. Portal blood by-pass resulting in the prevention of a high portal pressure prevented bloody diarrhea. The mechanism of bloody diarrhea in shock appears to be as follows. In low flow states, hypoxia causes swelling of the centrilobular liver cells with blockage of some of the sinusoids. The increase in portal resistance, the entrance of high pressure arterial blood into the portal system, and intestinal hyperemia all combine to cause a high portal pressure which destroys the intestinal mucosa and allows fluid and blood to enter the lumen; the result is bloody diarrhea.

2834 DETECTION OF A VACCINE ANTIGEN IN THE SUPERNATANT OF A Salmonella typhimurium (STRAIN M-206) CULTURE. *(Fr.)* Ivanoff, B.; Creach, O.; Delorme, P.; Laval, F.; Fontanges, R. (Res. Cent., Army Health Dep., Lyon, France). *C. R. Acad. Sci. [D] (Paris)* 280(6):791-793, 1975.

2835 INTESTINAL BACTERIAL REDUCTION OF 4,4'-DIHYDROXYSTILBENE TO 4,4'-DIHYDROXYBIBENZYL. *(E.)* Tay, L. K.; Sinsheimer, J. E. (Coll. Pharm., Univ. Michigan, Ann Arbor). *J. Pharm. Sci.* 64(3): 471-472, 1975.

2836 THE IN VIVO REDUCTION OF COMPOUNDS CONTAINING THE NITRO GROUP: ITS RELATION TO THE CHARACTER OF THE INTESTINAL MICROFLORA. *(E.)* Wheeler, L. A.; Soderberg, F.; Goldman, P. (Harvard Med. Sch., Boston, Mass.). *Fed. Proc.* 34(3):742, 1975.

2837 THE ESTERIFICATION OF LITHOCHOLIC ACID BY FECAL MICROORGANISMS. *(E.)* Kelsey, M. I.; Thompson, R. J. (Natl. Cancer Inst. Frederick Cancer Res. Cent., Md.). *Fed. Proc.* 34(3):560, 1975.

2838 CHOLIC ACID-INDUCED INCREASES IN INTESTINAL MUCOSAL RENEWAL RATES AND RADIOSENSITIVITY IN GERMFREE CFW MICE. *(E.)* Mastromarino, A.; Wilson, A. (Baylor Coll. Med., Houston, Tex. *Fed. Proc.* 34(3):916, 1975.

2839 CITRIC, OROTIC, AND OTHER ORGANIC ACIDS IN RATS INJECTED WITH ACTIVE OR INACTIVE UREASE. *(E.)* Prior, R. L.; Zimber, A.; Visek, W. J. (Dep. Anim. Sci., Cornell Univ., Ithaca, N. Y.). *Am. J. Physiol.* 228(3):828-833, 1975.

2840 INFLUENCE OF SHORT TERM FASTING ON ALIMENTARY CANAL MUCOSA. *(E.)* Bayer, R. C.; Bird, F. H.; Chawan, C. B.; Smith, M. A. (Dep. Anim. Vet. Sci., Univ. Maine, Orono.). *Fed. Proc.* 34(3): 916, 1975.

2841 EFFECT OF ^{90}Y INHALED IN FUSED CLAY PARTICLES ON THE GASTROINTESTINAL TRACT OF BEAGLES. *(E.)* Hahn, F. F.; Barnes, J. E.; Hobbs, C. H.: Mauderly, J. L. (Inhalation Toxicol. Res. Inst., Lovelace Found., Albuquerque, N.M.). *Radiat. Res.* 61(3): 444-456, 1975.

2842 CHROMATOGRAPHIC DETECTION OF MELATONIN (5-METHOXY-N-ACETYLTRYPTAMINE) AND ITS BIOLOGICAL PRECURSORS IN ENTEROCHROMAFFIN CELLS. *(Rus.)* Kvetnoi, I. M.; Raikhlin, N. T.; Tolkachev, V. N. (Inst. Exp. Clin. Oncol., Moscow, USSR). *Dokl. Akad. Nauk SSSR* 221(1):226-227, 1975.

2843 EXPERIMENTAL PROTEIN-CALORIE MALNUTRITION IN THE RAT: BLOOD CHEMISTRY AND ETHANOL INFLUENCE. *(E.)* Jaggannathan, S. N.; Rodman, N. F. (Dep. Pathol., West Virginia Univ., Morgantown). *Fed. Proc.* 34(3):895, 1975.

2844 EFFECT OF THE LIVER ON THE PLASMA HISTAMINE CONCENTRATION. MEASUREMENTS PERFORMED ON PRE-AND POSTHEPATIC BLOOD BEFORE AND AFTER ABDOMINAL SURGERY. *(Ger.)* Beger, H. G.; Stopik, D.; Bittner, R.; Kraas, E.; Roscher, R. (Westend Clin., Free Univ. Berlin, Germany). *Z. Gastroenterol.* 12 (Suppl.):405-406, 1974.

2845 EFFECTS OF ACUTE SEVERE HEMORRHAGE ON HEMODYNAMICS AND METABOLISM OF THE BABOON INTESTINE. *(E.)* Alteveer, R. J.; Reed, E. A. (Hahnemann Med. Coll., Philadelphia, Pa.). *Fed. Proc.* 34(3):379, 1975.

2846 EFFECT OF INTRAVENOUS CHOLECYSTOKININ AND ISOPROTERENOL AND INTRADUODENAL FAT ON JEJUNAL BLOOD FLOW DISTRIBUTION. *(E.)* Fara, J. W.; Campbell, R.; Madden, K. (Dep. Physiol. Biophys., State Univ. New York, Stony Brook). *Fed. Proc.* 34 (3): 460, 1975.

2847 EFFECTS OF CHOLECYSTOKININ-OCTAPEPTIDE (CCK-OP) ON HYPOTHALMIC ELECTRICAL ACTIVITY. *(E.)* Dafny, N.; King, M. C.; McClung, R.; Jacobson, E. D. (Univ. Texas Med. Sch., Houston). *Fed. Proc.* 34(3):441, 1975.

2848 LIVER BLOOD FLOW AND BLOOD VOLUME FOLLOWING CHRONIC PHENOBARBITONE ADMINISTRATION. *(E.)* Ohnhaus, E. E.; Lochner, J. T. (Dep. Med., Univ. Bern, Switzerland). *Eur. J. Pharmacol.* 31(2):161-165, 1975.

2849 THE EFFECT OF PROPRANOLOL AND PHENTOLAMINE ON HYPERGASTRINEMIA RESULTING FROM RESPIRATORY ACIDOSIS IN NORMAL SUBJECTS. *(Fr.)* Kaess, H.; Teckentrupp, G.; Hauck, A.; Dorner, M. (Ludolph Krehl Clin., Heidelberg, Germany). *Biol. Gastroenterol. (Paris)* 7(4):297, 1974.

2850 EFFECT OF PROSTAGLANDINS E_1 AND A_2 ON PROLIFERATION AND PHAGOCYTOSIS OF CULTURES OF MOUSE PERITONEAL MACROPHAGES. *(Fr.)* Pelletier, M.; Adolphe, M.; Fontagne, J.; Timsit, J.; Lechat. P. (CNRS Lab. No. 206, Pract. Sch. Higher Stud. Paris, France). *C. R. Acad. Sci.* [*D*] *(Paris)* 280(10):1317-1320, 1975.

2851 ELECTROFOCUSING STUDY OF INTESTINAL MALTASE FROM THE RAT DISSOLVED BY PAPAIN AND DIGITONIN. *(Fr.)* Sudaka, P.; Delmont, J.; Rigat, A. M. (Fac. Med., Nice, France). *Biol. Gastroenterol. (Paris)* 7(4):305-306, 1974.

2852 ENTERO-BACTERIAL FORMATION OF CYCLOHEXYLAMINE IN RATS INGESTING CYCLAMATE. *(E.)* Bickel, M. H.; Burkhard, B.; Meier-Strasser, E.; Ven Den Broek-Boot, M. (Med. Chem. Inst., Univ. Bern, Switzerland). *Xenobiotica* 4(7):425-439, 1974.

2853 THE EFFECT OF γ-IRRADIATION ON THE HEPATIC TRANSPORT OF AMINO ACIDS. *(E.)* Flory, W.; Jennewein, S. (Dep. Biochem., Univ. South Dakota, Vermillion). *Fed. Proc.* 34(3):556, 1975.

2854 EFFECT OF AMINO ACID TRANSPORT ON THE ACCUMULATION OF LIVER GLYCOGEN IN RATS AFTER WHOLE-BODY IRRADIATION. *(E.)* Kilberg, M.; Neuhaus, O. W. (Dep. Biochem., Univ. South Dakota, Vermillion). *Fed. Proc.* 34(3):556, 1975.

2855 THE RELATIONSHIP OF INTESTINAL ADHESIONS TO INFRARED HEATING LAMP EXPOSURE. *(E.)* Arima, E,; Fonkalsrud, E. W. (Sch. Med., Univ. California, Los Angeles). *J. Pediatr. Surg.* 10(2):231-234, 1975.

2856 OBLIGATORY URINARY AND FECAL NITROGEN LOSSES IN ELDERLY WOMEN. *(E.)* Perera, W. D. A.; Young, V. R.; Scrimshaw, N. S. (Massachusetts Inst. Technol., Cambridge). *Fed. Proc.* 34(3):930, 1975.

2857 BINDING OF ACETYLCHOLINESTERASE TO VARIOUS LIPIDS. *(E.)* Struve, W. G.; Watkins, M. S.; Goldstein, D. J.; Bulger, J. E. (Cent. Health Sci., Univ. Tennessee, Memphis). *Fed. Proc.* 34(3):326, 1975.

2858 EFFECTS OF MANIPULATION, DISTENSION AND PHYSOSTIGMINE ON COMPARTMENTAL BLOOD FLOW IN THE CANINE G-I TRACT. *(E.)* Grassmick, B.; Chou, C. C. (Dep. Physiol., Michigan State Univ., East Lansing). *Fed. Proc.* 34(3):460, 1975.

2859 INCREASE IN THE QUANTITY OF METABOLIC FECAL NITROGEN IN THE RAT FOLLOWING INGESTION OF DIETS CONTAINING TANNIC ACID. *(Fr.)* Mitjavila, S.; Mitjavila, S.; Derache, R. (Inst. Physiol., Toulouse, France). *Ann. Nutr. Alim.* 28(3):189-198, 1974.

2860 ELECTROMYOGRAPHIC STUDY OF DIAPHRAGMATIC MOTOR ACTIVITY DURING VOMITING IN THE NON-ANESTHETIZED DOG. *(Fr.)* Monges, H.; Salducci, J.; Naudy, B. (Clin. Gastrointest. Dis. Nutr., Marseille, France). *Biol. Gastroenterol. (Paris)* 7(4):291, 1974.

DIAGNOSTIC PROCEDURES

2861 150 PANCREATIC SCINTIGRAPHIC ANALYSES. COMPARISON OF RADIOCLINICAL AND SURGICAL FINDINGS. *(Fr.)* Batisse, R.; Charbord, P. (Val-de-Grace Hosp., Paris, France). *Ann. Med. Interne (Paris)* 125(10):731-736, 1974.

Comparisons were made of clinical, biological, radiological, scintigraphic, and surgical findings on 89 patients. These patients had acute or chronic pancreatitis (25 cases), cancer of the pancreas (7), pancreatic shunts (3), obstructions of the papilla (2), primary adenocarcinoma of the liver (1), Zollinger-Ellison syndrome (1), and pancreatic ischemia caused by stenosis of the celiac trunk (1); 49 patients had no pancreatic abnormalities. Pancreatic scintigrams were obtained by double labelling with ^{75}Se-selenomethionine and ^{99m}Tc and subtraction of the liver scan. In all but 10% of these patients, accurate diagnoses were established from pancreatic scans. In patients with atypical abdominal pain, normal scans often made it possible to rule out chronic pancreatitis. The only exceptions were those with caudal lesions, which are difficult to detect and which are usually found in alcoholics at the onset of chronic pancreatitis. Scans from patients with caudal lesions were difficult to interpret because of the small size of the organ and because loops of jejunum or a hyperplastic left lobe of the liver, such as that found in alcoholics, were superimposed on the scan. In patients with acute pancreatitis, pancreatic scans confirmed the diagnosis based on clinical and biochemical findings. Lesions less than 2 cm in diameter, which were found in nodular pancreatitis and cancer, were not detected on pancreatic scans. However, cancer of the head of the pancreas was accompanied by readily detectable stasis in the pancreatic duct above the tumor.

2862 RAPID METHOD FOR DOUBLE CONTRAST RADIOGRAPHY OF THE COLON: UTILIZATION OF GLUCAGON. *(Fr.)* Hage, G. (St. Marguerite Hosp., Marseille, France). *Arch. Fr. Mal. App. Dig.* 63(4): 297-303, 1974.

A new method for obtaining double contrast x-rays of the terminal ileum and colon was used on 130 patients (58 females and 72 males, aged 5-93 yr; mean age 44 yr). Five hr before the x-ray examination, patients received an i.v. injection of 2 mg glucagon and 5 mg diazepam and a 4 liter enema which they held for 20-30 min while changing their position from left lateral decubitus to prone and then to right lateral decubitus. To evacuate any remaining water from the rectosigmoid, Normacol powder was administered 1 hr before the examination. With the patient in the left lateral decubitus, 250-300 ml of contrast medium (density 1.600) were administered, followed by gradual insufflation, with the patient in a prone position, until the contrast medium reached the cecum. The colon was then completely insufflated while the patient was rotated 2-3 times, and the x-ray examination was completed in an average of 10-15 min. The use of glucagon made it possible to obtain excellent double contrast patterns of the mucosa and to opacify the distal ileum. In all but 4 or 5 cases, the patients, including those with Crohn's disease of the colon and ulcerative colitis, tolerated the enema well. Although the enema was not properly administered in 12 cases, the examination had to be performed again in only 3. By means of double-contrast radiography, 24 organic lesions of the colon and terminal ileum were demonstrated. Of 10 patients with diverticula of the colon, 4 had isolated diverticula in the right colon, a finding which has not been reported before.

2863 MEASUREMENT OF CIRCULATING DESIALYLATED GLYCOPROTEINS AND CORRELATION WITH HEPATOCELLULAR DAMAGE. *(E.)* Marshall, J. S.; Green, A. M.; Pensky, J.; Williams, S.; Zinn, A.; Carlson, D. M. (Case West. Reserve Univ. Sch. Med., Cleveland, Ohio). *J. Clin. Invest.* 54:555-562, 1974.

The binding of human thyroxine-binding globulin to hepatic cell plasma membranes on desialylation was studied. The amount of [^{125}I]desialylated thyroxine-binding globulin (DTBG) bound to rat liver cell plasma membranes progressively increased on the addition of further desialylated glycoprotein, until a point at which the binding sites were apparently saturated. The results of inhibition assays in which purified unlabeled desialylated glycoprotein were preincubated with the membranes showed that unlabeled DTBG prevented the binding of approximately 90% of the [^{125}I]desialylated orosomucoid at a concentration of 2 µg/ml. Desialylated orosomucoid appeared to have a greater affinity than DTBG for the plasma membrane binding sites. Similarly, desialylated fetuin and desialylated ceruloplasmin bound less avidly than DTBG. In testing the serum from patients with a variety of illnesses, serum from patients with Laennec's cirrhosis, biliary cirrhosis, hepatic metastases, and alcoholism with a primary hepatoma demonstrated greatly increased inhibitory activity. However, four patients with jaundice secondary to common bile duct obstruction by tumor, one with ascites secondary to pancreatitis, another with abnormal liver function tests due to congestive heart failure, and two with markedly abnormal rheumatoid factor latex fixation tests had serum with inhibitory activity within the normal range. No simple correlation was found between serum inhibitory activity and levels of alkaline phosphatase, SGOT, total bilirubin, serum albumin, or serum globulin. Column chromatography on Sephadex G-200 of a sample of serum from a liver cirrhosis patient showed the expected reversal of albumin to globulin ration compared to normal serum. Results of this study indicate that the hormone transport protein, glycoprotein thyroxine-binding globulin, may now be added to the group of serum glycoproteins which, after desialylation, bind to liver cell membranes. As for the clinical importance of this inhibition assay, Laennec's cirrhosis, biliary cirrhosis, primary and metastatic liver carcinoma, and hepatitis appear to be associated with elevated levels of circulating desialylated glycoproteins. Patients with abnormal liver function tests due to congestive heart failure, pancreatitis, or extrinsic biliary tract obstruction had normal inhibitory activity.

2864 D-XYLOSE ABSORPTION TEST AND QUANTITATIVE IMMUNOGLOBIN DETERMINATION AS SELECTION CRITERIA FOR PERFORMING PERORAL ASPIRATION BIOPSIES OF THE SMALL INTESTINE. *(Ger.)* Tinschmann, P.; Bertholdt, F. (Pediatr. Clin., Univ. Dusseldorf, Germany). *Monatschr. Kinderheilk.* 122(7):575-577, 1974.

Peroral biopsies and xylose tests were performed on 60 children, aged 6 weeks to 4 yr, who were suspected of suffering from malabsorption. Total atrophy of the villi was found in 16 biopsies. The data were categorized as either concordant or discordant and were evaluated for (1) length of time between the 2 tests (with the xylose test always preceding the biopsy) and (2) length of diet therapy before the first test. When tests were performed 0 to 10 days apart, results agreed on 75%; for a period of 11 to 21 days, only 47% agreed. After 0 to 10 days of diet therapy, results agreed in 80%, while after diet therapy for 11 to 21 days, only 18% agreed. Agreement after 21 days of therapy increased again to 78%. This suggests that the absorption of the mucosa responds more quickly to treatment than do morphological changes in the mucosa. Immunoglobulin determinations, performed in 38 cases, showed that patients with mucosal atrophy had IgA levels significantly higher than normal. Results from the D-xylose test and biopsy agree if both are performed simultaneously before institution of therapy. Celiac disease can be diagnosed with a high degree of accuracy in patients with decreased D-xylose absorption and increased IgA levels.

2865 EVALUATION OF FOUR VARIANTS OF THE INDIRECT HEMAGGLUTINATION TEST FOR HUMAN HYDATIDOSIS. *(E.)* Varela-Diaz, V. M.; Lopez-Lemes, M. H.; Prezioso, U.; Coltorti, E. A.; Yarzabal, L. A. (Pan Am. Zoonoses Cent., Panam. Health Organ./World Health Organ., Buenos Aires, Argentina). *Am. J. Trop. Med. Hyg.* 24(2):304-311, 1975.

The comparative sensitivity and specificity of the tannic acid, glutaraldehyde, benzidine and formol indirect hemagglutination test (IHA) were evaluated in the immunodiagnosis of human hydatidosis. Using the same pool of hydatid cyst fluid, 74 hydatosis sera were examined by each of the four IHA techniques. When the criterion for IHA test positivity was based on the observation of hemagglutination titers of 1:32 and above, the comparitive sensitivity of the four tests was found to vary with the group of sera examined. The highest titer at which hemagglutination was observed in non-hydatid sera was 1:32 with tannic acid, 1:256 with glutaraldehyde, and 1:128 with benzidine and formol-treated cells. Both the sensetivity and non-specificity of each IHA test variant was higher when the positivity criterion was based on the detection of reactors than when only titers were considered. The low rate of nonspecific reactions and higher sensitivity of the tannic acid IHA test, based on a diagnostic titer for hydatidosis as positivity criterion, suggest that it is more effective than the glutaraldehyde and benzidine tests.

2866 PREOPERATIVE CYTOLOGICAL DIAGNOSIS OF GASTRIC LEIOMYOSARCOMA. A REPORT OF THREE CASES. *(E.)* Cabre-Fiol, V.; Vilardel, F.; Sala-Cladera, E.; Perez Mota, A. (Santa Cruz San Pablo Hosp., Barcelona, Spain). *Gastroenterology* 68(3): 563-566, 1975.

The cytological characteristics of three recent cases of gastric leiomyosarcoma in which the diagnostic cells were obtained by an endoscopic cytology technique are described. Previous radiological diagnoses were malignant ulcer in one case, probable benign ulcer in one case, and multiple benign tumors in the third case. The diagnostic cells were obtained by exfoliative cytology using a brushing technique under direct vision. Malignant cells, mostly spindle-shaped, were found isolated or forming small groups. The cells had very elongated, clear cytoplasm with no vacuoles. The nuclei were hypertrophic, ovoid, and sometimes rounded. Chromatin distribution in the nuclei was irregular and in some instances the nuclei appeared segmented. Occasionally, malignant cells contained several, small superimposed nuclei with thick nuclear membranes and prominent nucleoli. Some such cells resembled epidermoid tadpole cells, while others featured an extremely long, fiber-like cytoplasm. These cells were interspersed with large, undifferentiated malignant cells. Sheets of cells from the superficial columnar epithelium were found in all smears; many exhibited signs of chronic gastritis. In two cases, gastroscopic biopsies showed normal superficial epithelium, and in the third case, several biopsy specimens showed malignant tissue. The definitive histological diagnosis in all cases was gastric leiomyosarcoma. The superiority of cytology over biopsy in this group of tumors may be explained in part by the submucosal growth of leiomyosarcoma, which prevents adequate biopsies, and in part by the wider area of samples of abrasive techniques under direct vision.

2867 ULTRASONICALLY GUIDED PERCUTANEOUS FINE NEEDLE BIOPSY OF THE PANCREAS. *(E.)* Hancke, S.; Holm, G. G.; Koch, F. (Gentofte Hosp., Hellerup, Denmark). *Surg. Gynecol. Obstet.* 140(3): 361-364, 1975.

A new method for the preoperative demonstration of malignant conditions of the pancreas is presented and preliminary results using it reported. By ultrasonic scanning of the abdomen, cross-sectional views of the organs, including the pancreas, can be outlined on an oscilloscope screen; lesions may thereby be demonstrated providing they have a certain minimum size. When a lesion is outlined, a guided puncture can be performed with a special ultrasonic transducer; the needle will follow exactly the direction of the sound beam emitted from the transducer. The ultrasonic scanning is performed with the patient in the supine position. When the lesion is located, the optimal place for the puncture is marked on the skin. The depth of the lesion is read from the oscilloscope screen and is marked on the fine needle. Aspirations are performed according to the technique described by Franzen. Routinely, 4 to 6 punctures in various directions are performed through the same guide cannula. Between July 1973 and September 1974, ultrasonic investigation was

performed in about 410 patients, of whom 80 were found to have pancreatic disease. In 36 patients with suspected pancreatic lesions, scanning demonstrated a solid mass lesion in the pancreas; 21 biopsied patients had carcinoma and four had chronic pancreatitis. In 17 of the carcinoma patients, tumor cells were aspirated; the cells were numerous and easily recognizable, fulfilling the cytologic criteria of malignant disease. Aspirations could not be adequately performed in three carcinoma patients and normal pancreatic cells were aspirated from a fourth. In the four patients with chronic pancreatitis, normal pancreatic cells were aspirated. There were no immediate complications due to fine needle biopsy. The combination of ultrasonic scanning and ultrasonically guided percutaneous fine needle aspiration is an important adjunct to the management of pancreatic lesions, although more investigation is needed regarding the diagnostic sensitivity of the scanning technique and the cytologic evaluation of the aspirates.

2868 DIAGNOSIS AND PROGNOSIS IN COLON CANCER BASED ON A PROFILE OF IMMUNE REACTIVITY. *(E.)* Lurie, B. B.; Bull, D. M.; Zamcheck, N.; Steward, A. M.; Helms, R. A. (Boston City Hosp., Mass.). *J. Natl. Cancer Inst.* 54(2):319-325, 1975.

An immunologic profile consisting of measurements of circulating carcinoembryonic antigen (CEA), tumor antigen-induced inhibition of mononuclear cell migration (IMM), and skin reactivity to purified protein derivative, streptokinase-streptodornase, and mumps was assessed in 16 patients (4 female) with colon cancer. Before surgery, 10 of 14 patients tested had elevated CEA levels, 12 of 12 showed positive IMM, and 10 of 11 failed to react to two or more recall skin-test antigens. Among seven patients whose tumor were limited to the bowel wall and presumably completely removed at surgery, CEA assays either remained negative or became negative during the first month after surgery. Elevated CEA levels later occurred in three patients, none of whom showed evidence of recurrent colon cancer. All seven patients showed negative IMM tests 2 or more months after surgery, and increased skin-test reactivity was seen in six patients 3 or more months after surgery. One patient with a negative reaction in all skin tests had rising CEA values. In nine patients whose tumor masses were not completely removed at surgery, all had elevated CEA levels within a short time after surgery, none showed tumor antigen-induced IMM, and six showed suppressed skin-test reactivity. CEA, IMM, and skin test results remained unchanged in three patients with nonmalignant lesions. Used separately, CEA, IMM, and skin reactivity to recall antigens have known limitations, but the combined use of all three improves diagnosis and prognosis in colon cancer patients.

2869 PAROTID SALIVA TEST COMPARED WITH PANCREOZYMIN-SECRETIN TEST IN DIAGNOSIS OF PANCREATIC DISORDERS. *(E.)* Kakizaki, G.; Saito, T.; Soeno, T.; Sasahara, M.; Ohizumi, T.; Kato, E.; Fujiwara, Y. (Akita Univ. Med Sch., Japan). *Tohoku J. Exp. Med.* 114(3):241-245, 1974.

The pancreozymin-secretin and the parotid saliva tests were compared with regard to their reliability as diagnostic tools for pancreatic disorders in 12 patients with pancreatic disorders and 10 with non-pancreatic disorders. Both tests gave fairly comparable results in the group of patients with pancreatic disorders. The parotid saliva test gave false negative results for 1 of 3 patients with cholecystolithiasis with satellite pancreatitis, whereas the pancreozymin-secretin gave negative results for all three patients. In one patient with cancer of the head of the pancreas the pancreozymin-secretin test gave more reliable results than the parotid saliva test. The parotid saliva test was negative in all patients with non-pancreatic disorders, while the pancreozymin-secretin gave false positive results in eight of 10 patients. Positive results of the pancreozymin-secretin test were 75% accurate and those of the parotid saliva test were 83.3% accurate in the 12 patients with pancreatic disease. In 10 patients with non-pancreatic disorders, the parotid saliva test was 100% accurate, while the pancreozymin-secretin test gave very high false positive results. As a whole, a positive parotid saliva test was 90.9% accurate in diagnosing pancreatic disorders, while a positive pancreozymin-secretin test was only 50% accurate. It is suggested that the parotid saliva test is a potentially useful test in predicting the presence or absence of pancreatic disorders regardless of the presence of abnormal biliary function or of duodenal disease.

2870 USE OF THE ENTEROTEST DUODENAL CAPSULE IN THE DIAGNOSIS OF GIARDIASIS. A PRELIMINARY STUDY. *(E.)* Thomas, G. E.; Goldsmid, J. M.; Wicks, A. C. B. (Dep. Med., Univ. Rhodesia, Salisbury). *S. Afr. Med. J.* 48(53):2219-2220, 1974.

The Enterotest capsule was compared with stool examination and jejunal aspirate as a method for finding *Giardia lamblia* in patients under investigation for malabsorption as a cause of megaloblastic anemia. The Enterotest consists of a gelatin pharmaceutical capsule lined with silicone rubber in which is embedded a 1 g spherical lead weight. Packed inside the capsule is 140 cm of thread and 3-ply white nylon yarn with the free end protruding through a hole in one end of the capsule. When the capsule is swallowed, the free end of the yarn is attached to the patient's mouth. The gelatin dissolves in the stomach leaving a small lead-weighted rubber bag which passes through the pylorus. When the yarn is withdrawn, it leaves the rubber bag to pass in the stool. The mucus which adheres to the yarn is scraped off and examined microscopically for parasites. The Enterotest was positive 5 of 6 times and the jejunal aspirate from the Crosby capsule 4 of 7 times. The first stool was positive twice and the second stool twice; in two patients three consecutive stools were negative. It is concluded that the Enterotest is a safe and effective technique for screening patients for upper gastrointestinal parasites and appears to be more useful than stool and biopsy examination.

2871 RADIOMANOMETRY IN THE DIAGNOSIS OF COMMON BILE DUCT DISEASE. *(E.)* Mieny, C. J.;

Mendelow, D.; Cooke, P. (J. G. Strydom Hosp., Johannesburg, South Africa). *S. Afr. J. Surg.* 12(4): 189-191, 1974.

Pressure and flow measurements were made during biliary surgery in 44 cases. An 8 F.g. feeding tube was inserted through the cystic duct into the common duct and a standard cholangiogram was performed. The barrel of a 20 ml disposable syringe was then connected to the tube and filled with saline. The barrel was raised beside a vertical ruler and opening pressure recorded when the level began to drop. Flow rate per min was recorded at opening pressure and at 30 cm. In 28 cases presenting with stones in the gallbladder but normal common ducts, opening pressure was 14 cm saline, and flow rate 25 ml/min at 30 cm. In 12 cases with stones in the common duct, opening pressure was 28 cm, and flow rate 14 ml/min. In four miscellaneous cases (two pancreatitis, one common bile duct carcinoma, one dilated common bile duct) opening pressure was 23 cm and flow rate 13 ml/min. It is concluded that when opening pressure is over 20 cm, exploration of the common bile duct is indicated.

2872 SEPTIC COMPLICATIONS FOLLOWING ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY. *(E.)* Davis, J. L.; Milligan, F. D.; Cameron, J. L. (John Hopkins Med. Inst., Baltimore, Md.). *Surg. Gynecol. Obstet.* 140(3):365-367, 1975.

Four cases of septic complications resulting from retrograde cholangiography and pancreatography are presented. In each case, pyrexia and usually abdominal pain appeared within 48 hr after the procedure. Stasis was present in each of the cases, but was unlikely in itself to have been sufficient cause. Infection may have been due to cannulation by introduction of bacteria, or by dissemination of already contaminated bile. In each case immediate surgery was performed, and recovery was successful in all but one patient, who had diffuse metastatic carcinoma of the liver. It is suggested that early operative intervention be planned for any patient in whom the procedure demonstrates stasis. The abdomen should be x-rayed 12-24 hr after the procedure to check for retained contrast media. Any patient developing abdominal pain and fever not responsive to antibiotics, fluid therapy or nasogastric suction should undergo immediate laparotomy. Finally, it is suggested that all patients undergoing this procedure be given antibiotic treatment.

2873 ANGIOGRAPHY OF GALLBLADDER CANCER. *(E.)* Kido, C.; Hibino, K.; Kaneko, M.; Sasaki, T. (Aichi Cancer Cent. Hosp., Japan). *Nippon Acta Radiol.* 34(1):1-11, 1974.

Selective angiography was evaluated in the diagnosis of gallbladder cancer. Twenty-five cases presenting with either a palpable tumor in the right hypochondrium, or jaundice, or both were studied. The cystic artery showed vasodilation in 17 cases (68%), hypervascularity in 20 cases (80%), and tumor-stain in 16 cases (64%). These blood vessels showed luminal irregularity and stiffening in 64%, displacement or interruption due to gallbladder swelling in 32%, slight displacement to the left of the gastroduodenal artery in 44% and stenosis or interruption of the gastroduodenal artery or proliferation of minute blood vessels in 12%. On histological examination, adenocarcinoma was found in 17 cases, papillary adenocarcinoma in two, anaplastic carcinoma in four, and mucoepidermoid and leiomyosarcoma in one case each. Liver metastasis was angiographically observed in 12, and liver cirrhosis in four cases. Gallbladder cancer was successfully diagnosed by angiography in 18 of 25 cases (72%). It is concluded that angiography provides a high rate of successful diagnosis, and is superior to other methods previously employed.

2874 THE BUDD-CHIARI SYNDROME: CORRELATION BETWEEN HEPATIC SCINTIGRAPHY AND THE CLINICAL, RADIOLOGICAL, AND PATHOLOGICAL FINDINGS IN NINETEEN CASES OF HEPATIC VENOUS OUTFLOW OBSTRUCTION. *(E.)* Tavill, A. S.; Wood, E. J.; Kreel, L.; Jones, E. A.; Gregory, M.; Sherlock, S. (R. Free Hosp., London, England). *Gastroenterology* 68(3): 509-518, 1975.

Between 1965 and 1972, 19 patients (12 female) with proven hepatic venous outflow obstruction were studied and the abnormalities observed on hepatic scintigraphy correlated with those seen on vascular radiology. In 10 cases, hepatic venous occlusion was secondary to other disorders, the most common being polycythemia rubra; in the remaining nine patients, no underlying cause for the hepatic venous occlusion was found. Serum albumin was reduced below normal levels in 12 patients, serum bilirubin was raised in 16 patients, and serum alkaline phosphatase was frequently raised although seldom excessively. Liver biopsies showed varying degrees of venous congestion, hemorrhage, and necrosis. In 15 patients, hepatic scintigraphy showed central localization of radiocolloid, this being the predominant feature in seven patients; normally, the maximum uptake is to the right of the midline. The inferior vena cava showed some degree of narrowing or distortion in its intrahepatic course in 13 patients, was occluded in three, and appeared normal in two. All but one patient showed a raised inferior vena cava pressure. Presumptive evidence of complete occlusion of the main hepatic veins was found in five patients; in nine others, a variety of venographic findings were demonstrated. Celiac axis arteriography showed stretching, arching, and attenuation in the intrahepatic arteries. Seventeen patients deteriorated progressively, the period between onset of symptoms and death ranging from 6 weeks to 3.5 yr. Ascites was a major problem in all but one patient. In six cases, autopsy revealed disproportionate enlargement of the caudate lobe, and in seven, the main hepatic veins were occluded by fibrous stenosis or organized thrombus. Additional studies indicated that the separate venous drainage of the caudate lobe may be preserved when the main hepatic veins are occluded and that hypertrophy of the caudate lobe occurs because of its relatively

more efficient perfusion. Demonstration of the enlarged caudate lobe by scintiscanning and inferior vena cavography provides valuable diagnostic support for the Budd-Chiari syndrome.

2875 SERUM FERRITIN IN PATIENTS WITH IRON OVERLOAD AND WITH ACUTE AND CHRONIC LIVER DISEASES. *(E.)* Prieto, J.; Barry, M.; Sherlock, S. (R. Free Hosp., London, England). *Gastroenterology* 68(3):525-533, 1975.

Serum ferritin concentrations in patients with acute and chronic liver disease were studied by immunoradiometric assay, and the test was evaluated as a measure of storage iron. Included were 11 patients with idiopathic hemochromatosis, one hematologically normal subject who had received iron-dextran i.m. over a 2-yr period, 20 patients with iron overload from hematological disease, 13 patients with acute non-alcoholic liver disease, 24 patients with alcoholic liver disease, 19 patients with cryptogenic cirrhosis, 11 with primary biliary cirrhosis, 28 normal controls, and five with chronic simple iron deficiency anemia. Serum ferritin showed a significant correlation with liver iron concentration in idiopathic hemochromatosis and in iron overload from hematological disease. In six patients with untreated hemochromatosis, serum ferritin levels of 1290-8300 µg/liter were found. In two of three patients with idiopathic hemochromatosis, the serum ferritin fell during phlebotomy therapy in an inverse exponential relationship with the cumulative amount of storage iron removed, but the rate of fall increased toward the end of the treatment as the ferritin levels became normal and sub-normal. In all three, liver iron concentration was high; hemosiderin granules were present in the portal tract and perilobular fibrous tissue, but only trace amounts of iron were found intracellularly. Ferritin levels were high in patients with acute and chronic liver disease, the highest values (over 27,600 µg/liter) in patients with viral and drug-induced hepatic necrosis. Although high ferritin levels were associated with severe or active hepatocellular disease, regardless of etiology, not all patients with increased transaminase values had high ferritin. Women and patients with recent hemorrhage tended to have lower ferritin levels. In patients with hepatocellular disease of rapidly changing activity, serum transaminase level changes were accompanied by proportional changes in serum ferritin. There was also a significant correlation between serum ferritin and aspartate transaminase in 63 patients, but this disappeared when the patients with ferritin levels above 1200 µg/liter were omitted. It is concluded that the ferritinemia of liver disease may be largely derived from damaged hepatocytes, and that serum ferritin measurement is an ideal way of monitoring the progress of idiopathic hemochromatosis patients during treatment.

2876 AMYLASE CLEARANCE IN DIFFERENTIATING ACUTE PANCREATITIS FROM PEPTIC ULCER WITH HYPERAMYLASEMIA. *(E.)* Warshaw, A. L.; Lesser, P. B. (Massachusetts Gen. Hosp., Boston). *Ann. Surg.* 181(3):314-316, 1975.

Patients (34) with abdominal pain, tenderness, and hyperamylasemia suggestive of acute pancreatitis were studied prospectively to elucidate the relationship between peptic ulcer disease and pancreatitis. The admitting diagnosis in each case was pancreatitis. The first group of 25 patients had a protracted course of illness consistent with acute pancreatitis as well as evidence of pancreatitis either on upper gastrointestinal series or at surgery. Seven patients (Group II) had rapid resolution of pain and had no evidence of pancreatic inflammation rather than high serum amylase and epigastric tenderness. The diagnosis of nonperforated peptic ulcer disease without concomitant pancreatitis was made both radiologically and at surgery in four patients and by upper gastrointestinal series alone in three. Two patients (Group III) had duodenal ulcers demonstrated by upper gastrointestinal series and signs of pancreatic swelling and inflammation. All patients had significantly elevated serum amylase, and the three diagnostic groups did not differ in urinary amylase, serum lipase, serum calcium, or white blood count. The amylase:creatinine clearance ratio was 3-fold higher than normal in the first and third groups, but normal in the second; there was very little overlap of the ranges for patients with and without pancreatitis. The amylase:creatinine clearance ratio is therefore useful for confirming or questioning the diagnosis of acute pancreatitis. Patients with normal clearance ratio should be evaluated immediately for other conditions which cause hyperamylasemia, including gastric or duodenal ulcer.

2877 REAPPRAISAL OF ENDOSCOPIC TISSUE DIAGNOSIS IN SECONDARY GASTRIC LYMPHOMA. *(E.)* Posner, G.; Lightdale, C. J.; Cooper, M.; Sherlock, P.; Winawer, S. J. (Mem. Sloan-Kettering Cancer Cent., New York, N.Y.). *Gastrointest. Endosc.* 21 (3):123-125, 1975.

A reappraisal of the ability of endoscopy to document the presence of gastric involvement in disseminated lymphoma is presented. Charts of 14 patients (seven female) with proven gastric lymphoma who had been endoscoped were reviewed. The reasons for endoscopy included upper gastrointestinal bleeding, abdominal mass, abdominal pain, and evaluation of the extent of disease in patients previously diagnosed . Ten of the patients had tissue diagnosis made at endoscopy, and in four patients, attempts to make an endoscopic diagnosis failed. In all patients a malignant neoplasm of unknown type was diagnosed by endoscopic visualization. Large, thickened folds were seen in 10 patients, and the folds appeared nodular in three additional patients. In one patient with reticulum cell sarcoma, there was rigidity and a malignant-appearing ulcer, and in one patient with Hodgkin's disease there was an ulcerated mass. Endoscopic cytological washings did not add to biopsy and directed brush cytology in obtaining malignant tissue. The results indicate that with current endoscopes and directed biopsy and cytology

techniques, there is a good likelihood of obtaining a tissue diagnosis in gastric lymphoma. In cases where gastric lymphoma is suspected, an aggressive attempt to confirm the diagnosis using these techniques is suggested.

2878 COMPARISON OF GASTRIC SECRETION STIMULATED BY HISTAMINE IN CONTINUOUS INFUSION AND IN A SINGLE SUBCUTANEOUS DOSE. *(Sp.)* Chahud, I. A.; Zegarra, A. C.; Bouroncle, C. J. M. (Hipolito Unanue Hosp., Lima, Peru). *Rev. Esp. Enferm. Apar. Dig.* 44(2):131-140, 1974.

A comparison was made between the augmented histamine test and the histamine infusion test in 16 patients. For the augmented histamine test, basal values for volume, acidity, and acid output were measured every 15 min for 1 hr. Patients received 10 mg of chlorpheniramine maleate i.m. 30 min before a single s.c. injection of 0.04 mg/kg histamine phosphate. The histamine infusion test, performed 48 hr later, consisted of slow i.v. infusion of 0.04 mg/kg histamine and measurement of volume, acidity, and acid output after basal values had been obtained. In the histamine infusion test, values for volume and acidity were higher and remained almost constant at a high level, while in the augmented histamine test these values increased within 15 min after administration of histamine and then, 45 min after injection, began to decrease. Better values for maximum acid output were also obtained with the histamine infusion test. Values of 18.757 and 18.757 mEq/hr were obtained for the 1st and 2nd hr after histamine infusion, in comparison to 14.031 and 10.031 mEq/hr, resp., obtained with the augmented histamine test. The difference between these results was significant, as was that for 15 min fractions. The side effects of histamine were less severe and less disagreeable when histamine was infused rather than injected s.c. The histamine infusion test is recommended for patients with hypochlorhydria and for evaluating the results of vagotomy.

2879 DOUBLE CONTRAST EXAMINATION OF THE STOMACH AS A PART OF ROUTINE DIAGNOSIS. *(Ger.)* Tschaikowski, K. L. (no affil.). *Leber Magen Darm* 4(4):158-164, 1974.

A technique has been developed by which double-contrast x-rays of the stomach can be obtained without insufflating the stomach with air. The patient is given hexocyclium methyl sulfate the evening before the examination to reduce gastric secretion and N-butylscopolammonium bromide s.c. 15 min before to reduce gastric motility and muscle tonus. The patient then receives 100 ml of contrast medium (Unibaryt C) to which a teaspoon of a special emulsion has been added to prevent gas bubbles and improve adhesiveness of the contrast medium. Paspertin (25 drops) is also added. The concentration of Unibaryt C should be higher than that recommended on the package. It is recommended that 3.4 parts of contrast medium be used to 1 part water. After this, the patient drinks an effervescent powder (tartaric acid and sodium bicarbonate, 1:1). After 3-5 min, the patient is positioned on his left side with his head lowered. If the stomach contains much fasting secretion or is very relaxed, 50-100 ml of normal contrast medium are administered. X-rays are then taken as with the double contrast method. The relief of the gastric mucosa shows up best when 70-90 kV are used.

2880 VALUE OF ARTERIOGRAPHY IN THE DIAGNOSIS OF CANCER OF THE GALL BLADDER. *(Fr.)* Coulomb, M.; Marty, F.; Baudin, P.; Aguettaz, G.; Geindre, M. (Univ. Hosp. Cent. Grenoble, France). *Ann. Radiol. (Paris)* 17(5):497-505, 1974.

The technique of celiac-mesenteric arteriography was evaluated in the diagnosis of 4 patients with gallbladder cancer. In three cases, arteriography supported the diagnosis of cancer of the gall bladder, while laparoscopy produced a conclusive diagnosis in only one case. In one case, a definitive diagnosis of gallbladder cancer was only made on operation, although reexamination of the arteriographic evidence after the fact showed clear signs of a malignant gallbladder tumor. Arteriographic evidence for gallbladder cancer included dilation of the cystic artery (in three of the four cases); parietal invasion or amputation of the cystic branches (in three cases); anarchic neovascularization (three); tumorography (four cases); abnormal venous return (two); signs of hepatic invasion (four cases); and loco-regional extension into the duodenopancreas, colon and venous portal system (one case). In this series, surgery was contraindicated in two cases. Contraindications included massive hepatic invasion, duodenopancreatic extension, and complete obstruction of the portal vein. The extent of the lesions and the feasibility of surgery can thus be assessed by means of angiography.

2881 RADIOLOGICAL SIGNS OF ILEOCOLIC INVAGINATIONS IN ADULTS: THIRTEEN CASES. *(Fr.)* Bret, P.; Piante, M.; Tran Minh, V.; Deliot, J. F. (Edouard-Herriot Hosp., Lyon, France). *Ann. Radiol. (Paris)* 17(5):471-477, 1974.

Ileocolic invagination was observed in 13 patients, aged 51-81 yr. The patients had presented with digestive hemorrhage, difficulty in intestinal transit, and pain. There were seven instances of cancer, including four epitheliomas and three sarcomas; four cases of benign tumors, including one adenoma and three lipomas; and two cases requiring no surgical intervention which appeared from the radiological evidence to be benign. Interpretation of the radiological evidence is facilitated when the obstruction is not complete. The picture of ileocolic invagination is characterized by segmentary enlargement of the

caliber of the colon, absence of fill-in of the dilated segment accompanied by a lacunary image, and specific characteristics of the lacunary image. Diagnosis of the benign or malignant nature of the tumor was possible radiologically in 2/3 of the cases. When the radiological evidence of a barium enema does not suffice, an intestinal transit should resolve doubts by identifying a slowing of the duration of transit in cases of intestinal stenosis; ascension of the ileocecal region; migration and infundibular aspect of the section; and generally satisfactory impregnation of this section contrasting with the lacunary image.

2882 PANCREATITIS: THE PANCREATOGRAM AND EXOCRINE PANCREATIC FUNCTION. *(Ger.)* Loffler, A.; Stadelmann, O.; Wobser, E.; Miederer, S. E. (Med. Polyclin., Univ. Bonn, Germany). *Leber Magen Darm* 4(5):195-200, 1974.

Endoscopic retrograde pancreatography and the secretin-pancreozymin test were performed on 46 patients who were recovering from acute or acute recurrent pancreatitis or who had clinically diagnosed pancreatitis or pancreatic calcification. Radiological findings were grouped into four stages: (0) no pathological changes; (1) circumscribed dilatations of the duct, isolated stenosis, and/or circumscribed or generalized parenchymal opacification which, in some cases, was associated with small cysts; (2) moderate dilatation of the entire main duct, isolated stenosis, and dilatation of accessory ducts; and (3) massive dilatation and stenosis of the entire duct system. Cysts were found in all stages. Results of the secretin-pancreozymin test were also grouped into four stages (0) normal findings; (1) normal bicarbonate values with decreases in one or more of the enzymes measured (amylase, trypsin, and chymotrypsin); (2) decreased bicarbonate values with normal enzyme levels or decreases in one or nore enzymes; and (3) maximum bicarbonate concentrations below the 3-σ limit with decreases in one or more enzyme. The results of these two tests agreed in 11 of the 23 patients (48%) with stage 0 findings in either the radiological or secretion test; in three of the 18 patients (17%) with stage 1 findings; and in only one of the 10 patients (10%) with stage 2 findings. However, the results of the two tests agreed in 11 of the 15 patients (73%) with stage 3 findings. Of the 19 patients with stage 1 or 2 radiological findings, 10 had normal pancreatic function, while only two patients with normal radiological findings had abnormal pancreatic function. In 15 cases the radiological findings were more abnormal than results of the pancreatic function test, but pancreatic function was more abnormal than radiological findings in only five cases. Therefore, in the early stages of chronic pancreatitis, endoscopic retrograde pancreatography is of more diagnostic value than the secretin-pancreozymin test.

2883 THE DIAGNOSIS OF PANCREATIC FUNCTION WITH THE ^{75}SELENOTHIONINE TEST. *(Ger.)* Dressler, J.; Hor, G.; Butterman, G.; Pabst, H. W. (Clin. Nucl. Med., Tech. Univ., Munich, Germany). *Munch. Med. Wochenschr.* 117(7):237-240, 1975.

After injection of ^{75}Se-methionine (0.3 µCi/kg i.v.) and pancreatic stimulation with 1 IU/kg secretin and 1 IU/kg pancreozymin, the activity of ^{75}Se-methionine and pancreatic secretion were studied in 5 samples of duodenal juice collected at 20 min intervals from 50 patients, 44 of whom had clinical signs of pancreatic disease. The concentrations and total quantities of amylase and trypsin were measured in the duodenal juice along with its volume, pH, and bicarbonate content. A significant correlation between ^{75}Se-methionine radioactivity and trypsin output was found in all fractions of duodenal juice but the first. The correlation between ^{75}Se-methionine and amylase was not as close. In these 50 patients, the results of the ^{75}Se-methionine test agreed with the clinically established diagnosis in 40 cases. False-positive and false-negative results were obtained in 2 cases each. Therefore, the ^{75}Se-methionine test can be used to study exocrine pancreatic function in place of enzymatic methods. By using pancreatic scintigraphy with the ^{75} Se-methionine test, information can be obtained about the morphology and function of the pancreas.

2884 X-RAY EXAMINATION OF THE GASTROINTESTINAL TRACT WITH A NEW BARIUM CONTRAST MEDIUM. *(Ger.)* Stallmann, K. (Lennep Hosp., Remscheid, Germany). *Leber Magen Darm* 4(4):164-166, 1974.

Barium sulfate Fertig Suspension (C. H. Boehringer & Son Co.) is a contrast medium with a low viscosity and high barium sulfate concentration which also contains dissolved carbon dioxide. For a stomach examination, 150-200 ml are usually required and for a contrast enema, 300-600 ml. This new contrast medium was used to perform x-ray examinations on 178 patients. The examinations consisted of 121 of the stomach and duodenum, 35 of the esophagus, 12 of the small intestine, and 10 of the colon. In most cases, exposures of the esophagus, stomach, and duodenum were taken in several planes with the patient's head lowered. Additional injection of a spasmolytic (40-80 mg of N-butylscopolammonium bromide) facilitates visualization of a hiatus hernia or esophageal varices. If the patient is positioned correctly, the contours of the gastric mucosa are visualized as they are by the double-contrast method. It is also possible to perform hypotonic duodenography with this contrast medium. The contrast medium reached the cecum after 1.5 hr at the most so that a complete diagnosis of the small intestine can be obtained routinely in a reasonable length of time. The carbon dioxide in the contrast medium eliminated the necessity of insufflating the colon with air to obtain double-contrast exposures.

2885 ECHOTOMOGRAPHIC AND ARTERIOGRAPHIC FINDINGS IN ACUTE HEMORRHAGIC PANCREATITIS: REPORT

OF ONE CASE. *(Fr.)* Gillet, M.; Combe, J.; Aubert, D.; Weill, F.; Ricatte, J. P.; Runser, C. (Univ. Hosp. Cent., Besancon, France). *Chirurgie* 99(10):727-733, 1973.

A 58-yr-old man with a 5 yr history of severe hypertension discontinued therapy (low-sodium diet, altizide, hydergine) and was hospitalized with a series of cerebrovascular accidents, renal failure, and increased serum amylase levels suggestive of acute pancreatitis. He spontaneously developed a huge abdominal mass and a large lumbar hematoma on the right in the absence of local injections or any abdominal trauma. By this time serum amylase activity had normalized, but serum lipase activity increased. Celiomesenteric arteriography revealed unusual vascular abnormalities which included irregular stenosis, segmental thrombosis, and leakage of the contrast medium, suggestive of a malignant lesion, probably an epithelioma or sarcoma, in the head of the pancreas. Echotomography initially revealed the presence of a pseudotumor in the head and neck of the pancreas, but a follow-up examination showed active necrosis. At surgery a hematoma the size of an orange was found in the root of the mesentery; this hemorrhagic mass involved the uncinate process of the pancreas and communicated with a larger, submesocolic mass which involved all but 3 cm of the tail of the pancreas. A subtotal, intracapsular sequestrectomy was performed with drains being placed in the stomach and gallbladder. Postoperatively, the patient's lipase levels returned to normal after 4 days, but severe renal failure persisted and an external pancreatic fistula developed. Although the fistula healed after a month, rapid increases in blood nitrogen and potassium necessitated many sessions of renal dialysis, and the patient died suddenly, 42 days after surgery, of massive gastrointestinal bleeding. In this patient, selective arteriography demonstrated the vascular origin of the pancreatitis: the intrapancreatic hematoma accounted for shunts from the superior mesenteric and gastroduodenal arteries; stenosis was caused by extrinsic compression of the Riolan's arcade; and pools of blood were probably associated with vascular erosions. Echotomography is considered superior to selective arteriography for the diagnosis of acute pancreatic necrosis since it is safer and easier to perform, can be repeated several times on consecutive days without discomfort, and is the only paraclinical examination which gives objective information about the evolution of pancreatic necrosis.

2886 ANGIOGRAPHY IN DIAGNOSIS OF SMALL BOWEL TUMORS. *(E.)* de Schepper, A.; Hubens, A.; van Vooren, W.; Verbraeken, H. (Dep. Radiol., Univ. Instelling, Antwerp, Belgium). *Radiologe* 14(9):425-430, 1974.

The findings of selective angiography of the visceral arteries in previous investigations of gastrointestinal hemorrhage have been tabulated and placed into 8 major groups: 1) arteries supplying the tumor are dilated and more rapidly filled than adjacent arteries; 2) rich vascularization with an enlarged number of arterioles, but regular in size and course, and early filling of the arteriolar network; 3) irregular, moniliform aspect of the arterioles; 4) infiltration, encasement and abrupt ending of the arteries and arterioles; 5) intensified tumor opacification in the capillary-parenchymatous phase, homogeneous contrast stain, dense but with well defined borders, sometimes with a ringlike appearence; 6) irregular pooling of contrast, along with a mottled or heterogeneous pattern of the tumor; 7) intratumoral filling defect due to necrosis, with or without central contrast extravasation; and 8) early and massive venous drainage with or without dilatation of the efferent veins. It is noted that angiographic findings often overlap. Thus, a predominance of groups 2 and 5 signs were noted in benign tumors; a predominance of symptoms 2 and 3, in malignant tumors. Groups 1 and 8 signs have been found to represent predominantly benign cases. It is concluded that, in the event conventional radiology fails, angiography may discover a tumor and provide information regarding localization and extent. To a lesser degree, it may also give an indication as to the nature of the lesion. Angiography may be used to confirm the diagnosis in cases of known or suspected tumor. In using angiography one must remember the ill-defined signs of some tumors and the lack of definite criteria to differentiate benign and malignant lesions. The angiographic information concerning localization, size, extent and sometimes nature of the small bowel tumor is, however, of extreme value in the preoperative screening of patients with gastrointestinal bleeding.

2887 GASTROINTESTINAL FIBER ENDOSCOPY: ADVANCES, LIMITATIONS, AND RISKS. *(Fr.)* Gaucher, A. (no affil.). *Rev. Fr. Gastroenterol.* (100): 5-12, 1974.

2888 THE UTILIZATION OF CRYSTALLINE PANCREATIC GLUCAGON IN ENDOSCOPIC AND ROENTGENOLOGICAL EXAMINATIONS OF THE INTESTINAL TRACT. *(Ger.)* Paul, F.; Freyschmidt, J. (Med. Coll., Hannover, Germany). *Z. Gastroenterol.* 12(8):614-615, 1974.

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2890 THE VALUE OF FIBER ENDOSCOPY IN UPPER GASTROINTESTINAL BLEEDING. *(Fr.)* Ribet, A. (no affil.). *Rev. Fr. Gastroenterol.* (100):29, 1974.

2891 ENDOSCOPY IN UPPER GASTROINTESTINAL BLEEDING: EXPERIENCE IN 72 CASES. *(Fl.)* Geboes, K.; Broeckaert, L.; Hellemans, J. (St. Rafael Univ. Hosp., Brussels, Belgium). *Tijdschr. Gastroenterol.* 17(2):129-137, 1974.

2892 ESOPHAGEAL VARICES: ACCURACY OF ENDOSCOPIC AND RADIOLOGICAL DIAGNOSIS. *(Ger.)* Kapp, F.; Faust, H. (Canton. Hosp., Basel, Switzerland). *Z. Gastroenterol.* 12(8):682-629, 1974.

2893 FIBER ENDOSCOPY IN DISEASES OF THE ESOPHAGUS AND GASTRIC CARDIA. *(Fr.)* Monges, H.; Hancy, A. (Nord Hosp., Marseille, France). *Rev. Fr. Gastroenterol.* (100):25-26, 1974.

2894 THE ROLE OF ENDOSCOPY IN DIAGNOSING THE CAUSE OF GASTRIC ULCERATIONS. *(Fr.)* Paris, J. (no affil.). *Rev. Fr. Gastroenterol.* (100): 13-18, 1974.

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See also, 2968, 3028, 3033, 3066, 3114, 3290, 3296, 3362, 3399, 3435, 3506, 3575, 3581, 3582, 3654, 3781.

GASTROINTESTINAL DISEASES

ESOPHAGUS

2968 OESOPHAGOSCOPY, BIOPSY, AND ACID PERFUSION TEST IN DIAGNOSIS OF 'REFLUX OESOPHAGITIS'. *(E.)* Sladen, G. E.; Riddell, R. H.; Willoughby, J. M. T. (St. Bartholomew's Hosp., London, England). *Br. Med. J.* 1(5949):71-76, 1975.

Endoscopic assessment of 71 patients with possible reflux esophagitis was compared with radiological findings, esophageal biopsy studies, and acid perfusion tests. All patients had chronic continuous or intermittent esophageal symptoms, some typical and some atypical for reflux esophagitis. Typical symptoms included pain or discomfort in the retrosternal area associated with either relationship to posture, aggravation by swallowing, and relief by antacids. Atypical symptoms included retrosternal pain or discomfort unaccompanied by any of the above features, pain in the epigastrium or abdomen, regurgitation or flatulence with no discomfort, upper gastrointestinal blood loss, or isolated dysphagia. Routine radiography showed no abnormality other than sliding hiatus hernia in 46, 20 of whom showed evidence of reflux. The entire esophagus was examined by endoscopy; evidence of esophagitis was based solely on the presence of mucosal friability. Biopsy specimens from macroscopically abnormal areas in 36 patients, or from random points in the distal 10 cm were assessed without knowledge of the symptoms or endoscopic findings. Acid perfusion tests were also performed in 48 patients. Endoscopic results showed the patients with typical symptoms had a higher incidence of endoscopic abnormality than those with atypical symptoms, and had a significantly higher incidence of radiologically demonstrable reflux. True reflux esophagitis was present in 1/3 of these. The histological studies showed a greater incidence of abnormality in patients with typical symptoms, but this was not statistically significant. The acid perfusion test results were positive in most patients (14) with typical symptoms, and only five with atypical symptoms. Statistically significant correlations were also found between the acid perfusion test and endoscopic abnormality. It is concluded that the acid perfusion test is useful in the diagnosis of atypical reflux symptoms, but endoscopy and biopsy should be limited for the few patients with special problems or for clarification of a radiological lesion.

2969 THE ASSOCIATION OF CARCINOMA OF THE ESOPHAGUS WITH ACHALASIA. *(E.)* Hankins, J. R.; McLaughlin, J. S. (Univ. Maryland Sch. Med., Baltimore). *J. Thorac. Cardiovasc. Surg.* 69(3):355-360, 1975.

Two case reports are presented of esophageal carcinoma found among 156 achalasia patients over a 13 yr period. The patients were a 33-yr-old black male who presented with dysphagia complicated by hematemesis and melena, and a 60-yr-old white male who presented with dysphagia of 10-15 yr duration and a 4-5 month history of epigastric pain, nausea, regurgitation, hematemesis, and melena. Squamous cell carcinoma was found at biopsy in both cases in addition to achalasia diagnosed by esophagograms. A review of the literature indicated a carcinoma incidence in achalasia of 1-7.7% in clinically diagnosed cases, and 20-29% when found at autopsy. Analysis of 78 cases since 1970 showed achalasia symptoms are present an average of 20 yr before carcinoma is diagnosed. The average age at diagnosis was 48-52 yr. The ratio of men to women was 2.8:1 despite greater frequency of achalasia in women. Treatment was the same as for carcinoma without achalasia, including esophagogastrectomy and radiation therapy; however, prognosis was worse. Of the 2 cases presented here, the 1st developed a recurrence after surgery and the patient died shortly after a 2nd operation. The 2nd patient developed a pyloric spasm 5 months after surgery, and a possible lymph node metastasis. It is emphasized that more attention be directed to prevention and early detection of this condition.

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ESOPHAGUS

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See also, 2892, 2893, 2943, 2959, 3081, 3198, 3551, 3689, 3694, 3734.

STOMACH

3008 ALCOHOL INJURY TO GASTRIC MUCOSA IN MICE AND ITS POTENTIATION BY STRESS. *(E.)* Kawashima, K.; Glass, G. B. J. (New York Med. Coll., N.Y.). *Am. J. Dig. Dis.* 20(2):162-172, 1975.

The role of alcohol in gastric mucosal injury, with and without stress, was studied in 423 Swiss-Webster mice. All mice were fasted 6 hr prior to and 3 hr after ethanol administration. Ethanol with water was administered by esophageal intubation to 204 mice in 4 concentrations (10%, 25%, 35%, or 50% vol/vol) and in 5 doses (1, 2, 3, 4, or 5 g/kg). Each group was studied after 6, 24, and 72 hr. In 45 mice, several doses were given over 3-5 consecutive days. In the remaining 120 mice, the effect of stress (1 hr restraint in a narrow tube at 8 C) was studied in combination with the ethanol. Of these, 48 were given ethanol prior to the stress, and the other 48 after stress. In half of each group, the ethanol concentration given was 25%; in the other half, 35%; half the mice were sacrificed after 6 hr, and the other 1/2 after 24 hr. For concentrations of 25% and greater, increasing dosages of ethanol caused a rapid increase in gastric erosions. At the 5 g/kg dose, erosion incidence reached 100% with the 35% concentration. At any particular dosage, increasing concentration caused increased erosion. At the 4 and 5 g/kg doses, erosion incidence was 0 at the 10% concentration, 67% at 25%, 76% and 100% at 35%, and 100% at 50% ethanol. In the mice given ethanol for 3-5 days, the 3 g/kg dose over 5 days produced a 67% incidence of erosion for both concentrations after 6 hr, 33% after 24 hr, and 0% after 72 hr. Stress alone caused hyperemia in 25% of the mice, while ethanol alone caused 30% hyperemia in 25% concentration at 3 g/kg. Combination of the alcohol and the stress was less than additive. When 35% ethanol at 3 g/kg was given before stress was applied, effects were greater than additive (ethanol, 37% incidence; stress, 35%; both, 83%).

There was a 27% incidence of gastric erosion with 35% ethanol at 3 g/kg; stress gave a 4% incidence; and both, a 50% incidence when the stress was first, and 71% when the ethanol was first. It is concluded that incidence of gastric erosion is significantly potentiated by stress, especially when stress is applied after ethanol.

3009 THYROGASTRIC AUTOIMMUNE DISEASE. STUDIES ON THE CELL-MEDIATED IMMUNE SYSTEM AND HISTOCOMPATIBILITY ANTIGENS. *(E.)* Whittingham, S.; Youngchaiyud, U.; Mackay, I. R.; Buckley, J. D.; Morris, P. J. (Walter and Eliza Hall Inst. Med. Res., Victoria, Australia). *Clin. Exp. Immunol.* 19(2): 289-299, 1975.

The role of cell (T-cell) mediated immunity was investigated in thyrogastric autoimmune disease. Twelve patients with autoimmune thyroiditis, and 27 with autoimmune gastritis were tested for specific cell-mediated responses to thyroid antigen by the leukocyte inhibition migration technique. In addition, general cell-mediated immunity to extrinsic antigens was tested for by cutaneous 1-chloro-2,4-dinitrobenzene response, response to 5 ubiquitous antigens, and lymphocyte blastogenic response to phytohemagglutinin. Finally, human leukocyte antigen (HL-A) phenotypes were determined. For each test, 26 normal volunteers served as controls. Leukocyte migration indices for chambers containing 100 µg of human thyroglobulin for the thyroiditis patients and controls were 0.79 and 1.1, resp. The indices for the chambers containing 200 µg gastric parietal cell microsomes were 0.78 and 1.1 for gastritis patients and controls, resp. When gastritis patient leukocytes were tested in human thyroglobulin and those from thyroiditis tested in gastric parietal cell microsomes results were ambiguous, leukocytes of some patients showing increased migration, and those of others decreased migration. The mean values (0.94 for thyroiditis patients tested with gastric parietal cell microsomes and 0.73 for gastritis patients tested with human thyroglobulin) were not significantly different from the control values (1.1) but the variability within the groups was highly significant in comparison with controls. Cutaneous response tests showed no significant results. HL-A typing showed a significant increase in frequency of HL-A3 and HL-A7 in the gastritis, but not the thyroiditis patients. However, this significance disappeared after a correction factor for the number of comparisons was applied. It is concluded that leukocyte inhibitory factor release is an index of specific cell-mediated immunity in thyrogastric autoimmune disease.

3010 STUDIES ON THE MECHANISM OF HYPOPROTEINEMIA IN GASTRIC CANCER. I. ALBUMIN LEAKAGE INTO THE STOMACH IN GASTRIC CANCER PATIENTS. *(E.)* Yamaoka, K.; Noguchi, S.; Higashi, H.; Jinnai, D. (Osaka Univ. Med. Sch., Japan). *Jpn. J. Clin. Oncol.* 4(2):97-104, 1974.

The leakage of serum albumin into the stomach in cases of gastric carcinoma was determined in 30 patients; 8 patients without carcinoma served as controls. ^{131}I-Human serum albumin (100 µCi) was injected i.v. after 3 days administration of potassium iodide as a thyroid block. On the following day the gastric contents were aspirated, the lumen rinsed with saline, and the gastric juice was continually neutralized with phosphate buffer and collected for 1 hr. After centrifugation the sediment was counted by scintillation counter. Leakage index was expressed as A/B x 100 where A represents total count/min sediment collected in 1 hr, and B represents count/min of 1 cc serum. In 16 cases values were less than 50, in 8 cases 50-100, in 3 cases 100-200, and in 3 cases over 200; the total average was 102.42. In contrast, control values were always under 100 and averaged 32.44. To determine whether gastric cancer producing mucus was related to leakage, sections of surgical specimens from the patients were stained by the PAS method. No correlation was found. There was also no correlation between leakage and sex, age, gastric acidity, Borrmann's type, histological type or size of crater. However, patients with the highest leakage rates had marked lymphatic cell invasion by carcinoma cells. It is concluded that gastric cancer hypoproteinemia may stem from serum protein leakage into the stomach, which in turn may be due to stasis of the lymphatic fluid.

3011 THE INFLUENCE OF CARBENOXOLONE ON STEROID-INDUCED ULCER AND MUCUS SECRETION IN THE RAT. *(E.)* Berg, M.; Geisel, A.; Necheles, H. (Michael Reese Hosp., Chicago, Ill.). *Am. J. Dig. Dis.* 20(2):134-137, 1975.

The protective effects of carbenoxolone sodium on prednisolone-induced ulceration were studied in 7 groups of 13 Holtzman rats each. The rats were fasted for 4 days and killed on the 5th with chloroform. Four groups were given prednisolone (3.5 or 5.0 mg s.c.) each dose with or without carbenoxolone (50 mg in 20 ml water, p.o.); 1 group carbenoxolone only; and 2 were control groups (1 fasted and 1 unfasted). Ulceration was observed in the stomachs, and mucus content was determined by determining dry weight before and after immersion in acetylcysteine. In all rats given drugs, ulceration of the squamous epithelium was found in only 1 of 50. There were no significant differences in size or number of ulcers of the glandular stomach in rats treated by both drugs or by prednisolone alone. The amount of mucus found in fasted control rats was significantly less than that of the treated groups and the fed controls, indicating that either drug or both prevents lowering of mucus in fasted rats. Histologic examination showed no differences between groups treated by prednisolone only, or by both drugs. It is concluded that prednisolone, carbenoxolone, or both are associated with prevention of ulceration, especially of the squamous epithelium, by maintaining normal amounts of mucus in fasted rats.

3012 FORMALDEHYDE-OZONE-INDUCED FLUORESCENCE IN GASTRIN-PRODUCING TUMORS. *(E.)* Larsson,

L. I.; Sundler, F.; Grimelius, L.; Hakanson, R.; Buffa, R.; Solcia, E. (Dep. Histol., Univ. Lund, Sweden). *Virchows Arch. [Pathol. Anat.]* 365(3):179-184, 1975.

Gastrin and glucagon-producing tumors were examined for formaldehyde-ozone-induced fluorescence in 8 patients. Tumor material was obtained at surgery or autopsy and subjected to formaldehyde and ozone, or indirect immunofluorescence for gastrin, insulin, glucagon, or ACTH. In 4 patients with Zollinger-Ellison syndrome, 3 had tumors in the pancreas, and 1 in the duodenal submucosa. Formaldehyde-ozone-induced fluorescence was found in the peripheral tumor cells in each case, and gastrin immunofluorescence was found in the same areas. There was little or no glucagon, insulin or ACTH immunofluorescence. Of 2 cases of insulin-secreting tumors, 1 showed moderate insulin immunofluorescence, and no gastrin or other immunofluorescence, or formaldehyde-ozone fluorescence. The other showed intense immunofluorescence of the glucagon cells, less of the insulin cells, and still less of the gastrin cells. Formaldehyde-ozone fluorescence could not be determined. A liver metastasis of this tumor showed much gastrin, moderate glucagon, and no insulin immunofluorescence. A small amount of formaldehyde-ozone fluorescence was also detected. One case of glucagon-secreting tumor showed only intense glucagon immunofluorescence. One case of gastric carcinoma showed only intense gastrin immunofluorescence, and a strong formaldehyde-ozone-induced fluorescence. It is concluded that the association between gastrin immunoreactivity and formaldehyde-ozone-induced fluorescence is a feature of gastrin-producing tumor cells.

3013 POSTOPERATIVE REFLUX GASTRITIS. *(E.)* van Heerden, J. A.; Phillips, S. F.; Adson, M. A.; McIlrath, D. C. (Mayo Clin., Rochester, Minn.). *Am. J. Surg.* 129(1):82-88, 1975.

Postoperative reflux gastritis was studied in 49 patients (28 males, 21 females, mean age 49.9 yr) who had undergone gastric or duodenal surgery 0-42 yr (average 6.1 yr) prior to the study. The chief clinical features of the reflux alkaline gastritis were epigastric pain, bilious vomiting, anemia (hypochromic, microcytic, iron-deficiency type), and the dumping syndrome. Gastroscopy was the most valuable diagnostic procedure with adherent mucus, edema, mucosal friability, and erosions (most severe on the gastric aspect of the stoma) being the most characteristic features. Gastric biopsy supported the macroscopic diagnosis. The Roux-en-Y biliary diversion was performed in 31 of the patients and a jejunal interposition was performed in 12 patients, but the best clinical results were seen in the Roux-en-Y diversion group. Medical treatment for reflux gastritis has not been adequately evaluated.

3014 THE RELATIONSHIP BETWEEN BILE AND HYDROCHLORIC ACID IN THE PATHOGENESIS OF ACUTE GASTRIC EROSIONS. *(E.)* Himal, H. S.; Boutros, M.; Weiser, M. (Dep. Exp. Surg., McGill Univ., Montreal, Canada). *Am. J. Gastroenterol.* 62(5):405-409, 1974.

The relationship between bile and hydrochloric acid in the pathogenesis of acute gastric erosions was studied in 15 mongrel dogs using explants of antrum which were placed within lucite chambers. Instillation of a control solution (120 mEq/liter HCl and 40 mEq/liter NaCl) into the antral chamber for four consecutive 30-min periods led to a net H^+ loss and a net Na^+, Cl^- and K^+ gain, but there was no measurable volume gain. Fresh canine gallbladder bile (10 ml) in contact with antral mucosa did not lead to gross or microscopic erosions, but instillation of the acid/saline control solution in the postbile period led to increased net H^+ Na^+ flux, net K^+ gain and net Cl^- loss, and acute erosions which appeared within 5 min of the control solution instillation. These erosions increased in size and number throughout the four test periods. There was minimal diffusion of H^+ into the antral mucosa, gallbladder bile alone did not cause acute antral mucosa erosions, but bile in association with hydrochloric acid did cause acute erosions when in contact with the antral mucosa. The underlying mechanism may be related to alterations in lysosomal activity.

3015 ATROPHIC GASTRITIS IN GASTRECTOMY SPECIMENS. *(E.)* Skinner, J. M.; Heenan, P. J.; Whitehead, R. (Radcliffe Infirm., Oxford, England). *Br. J. Surg.* 62(1):23-25, 1975.

Gastrectomy specimens from carcinoma and gastric ulcer patients were studied with regard to type and distribution of chronic gastritis, the presence of intestinal metaplasia, the site of the lesion, and any previous surgery. Blocks of tissue were taken from various areas of the stomach and stained by hemotoxylin and eosin, PAS, Foot's reticulin, and a modified Maxwell's method. Atrophic gastritis and intestinal metaplasia occurred almost entirely in the pyloric region or in the adjacent lesser or greater curves. Superficial gastritis was also seen in the pyloric region in about half the pyloric ulcer cases, while body ulcers were seen in all areas. This distribution was similar to that seen in the carcinoma cases, and in cases of gastrectomy following previous gastrojejunostomy for duodenal ulcer. There was a close association of atrophic gastritis and intestinal metaplasia with the development of cancer, and a high cancer rate after stomach operations for benign conditions. The similarity of distribution of atrophic gastritis and intestinal metaplasia in the stomach with body ulcer to that in cancer and after gastrojejunostomy suggested a higher cancer risk in body ulcer cases.

3016 THE ROLE OF STARCHES IN THE ETIOLOGY OF GASTRIC CANCER. *(E.)* Modan, B.; Lubin, F.; Barell, V.; Greenberg, R.; Modan, M.; Graham, S. (Chaim Sheba Med. Cent., Tel Hashomer, Israel). *Cancer* 34(6):2087-2092, 1974.

The role of starches in the etiology of gastric cancer was studied in gastric cancer patients, and several matched control groups (colorectal cancer patients; surgical cases with neither malignancy nor gastrointestinal disorders; and neighborhood controls).

The control groups were matched to the gastric cancer cases according to age, sex, ethnic origin, and length of residence in Israel. Comparison of the gastric cancer cases and the controls pertained to individual food items and groups of foods combined on the basis of common nutritional components, and paired t-tests were used to evaluate results. The gastric cancer patients ate on the average 26 items more frequently, 16 items with equal frequency and eight items less frequently than the colon cancer cases. For every food item eaten less frequently, three were eaten more frequently by the gastric cancer patients. There was a higher consumption frequency of starches among the gastric cancer patients, and this was not related to a socioeconomic differential. It was suggested that long-term consumption of starchy foods may affect the mechanics of gastric acid secretion and thus render the gastric mucosa more susceptible to exogenous carcinogens.

3017 MUCOSAL AND HEPATIC METABOLISM DURING THE SPONTANEOUS DISAPPEARANCE OF SALICYLATE-INDUCED GASTRIC EROSIONS. *(E.)* Hietanen, E. (Dep. Physiol., Univ. Turku, Finland). *Am. J. Dig. Dis.* 20(1):31-41, 1975.

The appearance and healing of salicylate-induced gastric erosions, and the mucosal and hepatic detoxification activity of salicylate was studied in 98 adult Wistar rats (84 males and 14 females). Salicylic acid was administered intragastrically (1-2 mM/kg body weight) once a day for 1-14 days, and the rats were killed 12 hr after the last dose. A single dose of salicylic acid (1-2 mM/kg body weight) caused erosions and bleeding in the gastric mucosa of all rats. After three daily doses, only slight gastric hemorrhage was observed in one of five rats at the 1 mM/kg dose, but at the dosage level of 2 mM/kg bleeding was present in two of five rats. Hepatic protein content decreased slightly after treatment, and in 2 weeks the decline was significant. The duodenal decrease was nearly significant after one mM/kg dose; after three doses there was a transient increase in protein content, whereas a significant decrease after three doses of 2 mM/kg was found. Gastric protein content showed a significant decrease after a single dose, but returned to control levels within 2 weeks. Gastric and duodenal UDP glucuronyltransferase activity decreased after a single dose of salicylic acid, but when the treatment was continued the enzyme activity increased above control level and in 2 weeks had returned to control level. Although the salicylates inhibited gastroduodenal glucuronidation *in vitro*, there was no substrate effect present when the rats were killed. Duodenal 3,4-benzpyrene hydroxylase activity was not affected by salicylic acid, and the gastric activity of this enzyme could not be measured by the methods used. Hepatic detoxification capacity was stable, however a slight depression of 3,4-benzpyrene hydroxylase activity did occur within 2 weeks. The results suggest that mucosal detoxification capacity may have a role in the pathogenesis of drug-induced gastric erosion. Gastric mucosa adapted to repeated salicylic acid administration, having reduced susceptibility to drug-induced erosions.

3018 GASTRIC MUCOSAL ISCHEMIA IN EXPERIMENTAL STRESS ULCER. *(E.)* Sales, J.; Norton, L.; Nolan, P.; Rankin, J.; Eiseman, B. (Denver Gen. Hosp., Colo.). *J. Surg. Res.* 18(1):65-74, 1975.

Blood flow patterns were quantitatively studied in the stomachs of 25 6-12-week-old piglets using isotopically labeled microspheres to investigate the pathogenesis of gastric ulceration following major blood loss. The left carotid artery and right external jugular vein were catheterized with 15-gauge polyethylene tubing. A similar catheter passed through the right femoral artery into the abdominal aorta. From 600,000 to 1,000,000 carbonized plastic microspheres labeled with ^{141}Cerium with a specific activity of 10 mCi/g were injected over 3 sec into the left ventricle. All 4 nonhemorrhaged animals survived anesthesia. Fifteen of 21 piglets survived hemorrhagic shock. Five of six piglets in which hemorrhagic shock was induced by bleeding 40% of the estimated blood volume survived hemorrhage. No gastric ulceration occurred in the survivors, which were sacrificed immediately after hemorrhage. Total gastric blood flow ranged from 18 to 81 ml/min. Mean values of total gastric blood flow showed a 70% decrease and these changes were reflected in the fall of average flow/g of the fundus-body (mean 59%) and antrum (mean 70%). Five of nine animals survived 90 min of hemorrhagic shock. Three survivors developed ulcers in the body of the stomach and two showed petechial lesions in the fundus. Total gastric blood flow was 9.5-60 ml/min. Blood flow to the fundus body decreased a mean 76% and to the antrum a mean 77%. After 90 min of shock, gastric mucosal flow became grossly uneven: 48% of fundus-body squares (1 cm each) had normal, 19% had high, and 33% had low flow compared to prehemorrhage values. Squares with low flow were distributed in an uneven fashion in the fundus-body and ulceration occurred principally in these squares. Five of six piglets survived 90 min of shock and retransfusion. Three survivors developed ulcers in the gastric corpus within 2 hr of hemorrhage. Total gastric blood flow ranged from 5.3 to 14 ml/min. The distribution of gastric blood flow was uneven after 90 min of shock. After retransfusion flow became even in two piglets but remained grossly uneven in three. Ulceration occurred in areas of low relative flow. These experiments show that decrease in blood flow in the swine stress ulcer model is not evenly distributed and that parts of the fundus-body and antrum are disproportionately ischemic. The findings suggest that uneven flow is not due to ulcer formation but that ulceration is etiologically related to ischemia.

3019 MORPHOLOGY OF GASTROINTESTINAL EFFECTS OF ASPIRIN. *(E.)* Hahn, K. J.; Krischkofski, D.; Weber, E.; Morgenstern, E. (Dep. Med., Univ. Heidelberg, Germany). *Clin. Pharmacol. Ther.* 17(3): 330-338, 1975.

The effect of aspirin on the ultrastructure of gastric mucosa and intestinal mucosal cells was investigated in the guinea pig and in man. Of 6 patients undergoing Billroth II operations, 3 were given 1 g aspirin/day 3-5 days prior to surgery, the remaining

3 serving as controls. For comparison, 5 guinea pigs were given 1 ml 45 mM aspirin solution in 2.5% alcohol 3 times/day for 4 days. Five control animals received only the alcohol. In 2 of 4 groups (2 animals each) gastric secretion was stimulated by 2 mg/kg betazole. In the other 2 groups, secretion was inhibited by 1 U/kg secretin. In all 4 groups, 1 ml of a 45 mM aspirin solution in 0.07 N NaOH, or 1 ml of pure 0.07 N NaOH was administered 15, 60, and 120 min after injection. Gastric and intestinal mucosa of control patients appeared normal under both light and electron microscopy. In patients given aspirin, surface mucous cells showed signs of cytolysis and desquamation. Many gastric parietal cells showed up to a 1 μm increase in lysosomal diameter and contained homogeneous and lamellar material, vesicular structures, and lipid droplets. No changes were found in the intestinal mucosa. In the guinea pigs, 4 day administration caused gastric mucosal superficial cells to exhibit the cytolytic signs of swollen nuclei and lighter cytoplasm. Similar effects, plus many small erosions, resulted from short-term aspirin treatment and betazole. The electron microscope showed surface mucosal cells exhibiting such cytolytic signs as pyknosis of the nucleus, clumping of the chromatin, and lysis of the cytoplasm and organelles. Lysosomes were not observed in mucosal cells, even after lengthy aspirin exposure. In the intestinal mucosa, electron microscopy showed fewer secondary lysosomes and multivesicular bodies than the gastric mucosa of human controls and control animals. Secondary lysosomes resembled those of gastric parietal cells in aspirin-treated patients. It is concluded that cytoplasmic damage by aspirin may induce hydrolase transport by multivesicular bodies and formation of autophagolysosomes.

3020 DISTRIBUTION OF GASTRIN IN HUMAN DIGESTIVE ORGANS DEMONSTRATED BY DIRECT IMMUNOFLUORESCENCE. *(E.)* Tobe, T.; Henmi, D.; Fukuchi, K.; Chen, S. T.; Tachibana, S. (Kyoto Univ. Med. Sch., Japan). *Arch. Histol. Jpn.* 37(1):59-72, 1974.

Immunofluorescence studies were performed on different portions of the human digestive tract to determine gastrin distribution. Antral stomach tissue from 15 gastric carcinoma patients, 15 peptic ulcer, and 4 benign adenoma patients given gastrectomies; and normal tissues from stomach, duodenum, jejunum, ileum, colon, rectum, pancreas, parotid gland and submandibular gland were examined. To determine glycine gastrin release, an antral section was immersed in 0.5 M glycine for 30 min and examined by immunofluorescence. Gastrin-containing cells were found in quantity in the antrum of the stomach, but none in the cardia. They were dispersed in the cryptal epithelium and in the middle zone of mucosal thickness. Most heavy concentrations were 2-4 cm proximal to the pylorus, becoming sparser in the pylorus. In the duodenum, the number of gastrin containing cells was lower than in the antrum and became increasingly lower distal to the pylorus. None were found in the jejunum, ileum, colon, rectum, esophagus, pancreas, parotid or submandibular glands. Gastrin fluorescence in antral tissue showed a slight decrease after immersion in glycine solution. In contrast, complete gastrin release resulted after freezing in an isopentane flask at -30 to -70 C. It is concluded that the gastrin-containing cells are only found in the antrum in great numbers, and to a lesser extent in the duodenum.

3021 CYTOHISTOCHEMICAL STUDIES OF THE EXOCRINE PANCREAS AFTER SUBTOTAL RESECTION OF THE STOMACH. *(Rus.)* Zufarov, K. A.; Tashkhodzhaiev, P. I.; Alizhanov, G. A.; Gontmakher, V. M. (Tashkent Med. Inst., USSR). *Arkh. Anat. Gistol. Embriol.* 67 (9):41-47, 1974.

Changes in the exocrine pancreas were studied in mongrel dogs sacrificed 5-360 days after subtotal stomach resection. In the early postoperative period (5-20 days), inflammatory, hemodynamic and slight destructive changes were observed. Intrapancreatic vessels and capillaries were dilated and filled with blood, and the intralobular connective tissue was swollen and infiltrated by lymphohistiocytic elements. The size of the nuclei in the acinar cells decreased by 6.5% compared with the controls. One to three months after surgery, the vasomotor and inflammatory process became subdued, while destructive processes developed. In addition to atrophic changes in the pancreas and the inhibited activity of the acinar cells, there was evidence of impaired secretion which was demonstrated by the presence of immature secretory granules in the acinar cells. It is suggested that subtotal resection entailed more profound degenerative changes in the pancreatic parenchyma than vagotomy. The degenerative and atrophic changes may be related to the impaired neurohumoral regulation of the pancreatic function. One year after surgery, a steady improvement in the histostructure of the exocrine pancreas was observed, characterized by the presence of enlarged acini, hypertrophy of acinar cells, elevated content of nucleic acids in the cells and an increase in the average size of the nuclei in the acinar cells. A partial regeneration of the pancreas as a long-term result of stomach resection may suggest a possible enhancement of the hormone influx from the jejunum. However, due to a slow rearrangement of this part of the stomach, the atrophy of the pancreas and the inhibition of its excretory function is the early postoperative consequence of the resection.

3022 REOPERATION ON THE OPERATED STOMACH. *(Ger.)* Schreiber, H. W.; Schumpelick, V.; Kauffmann-Mackh, G. (Surg. Clin., Univ. Hamburg-Eppendorf, Germany). *Therapiewoche* 24(17):1917-1926, 1974.

3023 UNUSUAL FINDINGS IN THE OPERATED STOMACH. *(Ger.)* Rosch, W.; Weidenhiller, S. (Med. Clin. Polyclin., Univ. Erlangen-Nuremberg, Erlangen, Germany). *Z. Gastroenterol.* 12(1):31-32, 1974.

3024 SERUM GASTRIN LEVEL AND GASTRIC SECRETION FOLLOWING PARTIAL AND TOTAL GASTRECTOMY. *(Ger.)* Fritsch, W. P.; Muller, J.; Rick, W.; Hausamen, T. U. (1st Med. Clin. A, Univ. Dusseldorf, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:826-827, 1973.

3025 DO HIGH BLOOD MAGNESIUM LEVELS RESULT IN DRUG-INDUCED VAGOTOMY? *(Ger.)* Strauch, M.; Lux, G.; Lux, E.; Ottenjann, R. (Neuperlach Munic. Hosp., Munich, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:834-837, 1973.

3026 ORAL ANTIBIOTIC THERAPY IN PATIENTS WITH PARTIAL GASTRECTOMY. *(Ger.)* Lode, H.; Frisch, D.; Naumann, P. (Med. Clin. Polyclin., Free Univ. Berlin, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:837-839, 1973.

3027 THE EFFECT OF INTRAVENOUS AMINOPLEX 5 ON SERUM GASTRIN AND GASTRIC SECRETION. *(E.)* Chatamra, K.; Pigott, H. W. S.; MacNaughton, J. I.; Wastell, C. (Gordon Hosp., London, England). *Postgrad. Med. J.* 51(591):1-3, 1975.

3028 A METHOD FOR INTRAGASTRIC TITRATION OF GASTRIC JUICE BY MEANS OF AN INTESTINAL TRANSMITTER PROBE. *(Ger.)* Unger, W.; Kaess, H. (Med. Clin., Univ. Heidelberg, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:830-832, 1973.

3029 GASTRIC BYPASS FOR MORBID OBESITY IN CHILDREN AND ADOLESCENTS. *(E.)* Soper, R. T.; Mason, E. E.; Printen, K. J.; Zellweger, H. (Univ. Iowa Hosp., Iowa City). *J. Pediatr. Surg.* 10(1):51-58, 1975.

3030 CONGENITAL GASTRIC DIVERTICULA. *(Rus.)* Gavrish, N. Iu. (Chernigov Dist. Oncol. Dispensary, USSR). *Vrach. Delo* (12):69-71, 1974.

3031 RELATIONS BETWEEN MUCOSAL MORPHOLOGY, THE PEAK ACID OUTPUT (PAO), AND THE SERUM GASTRIN LEVEL IN PATIENTS WITH HYPERCHLORHYDRIA, NORMOCHLORHYDRIA, HYPOCHLORHYDRIA, AND ACHLORHYDRIA. *(Ger.)* Miederer, S. E.; Stadelmann, O.; Kaess, H.; Elster, K. (Med. Polyclin., Univ. Bonn, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:823-825, 1973.

3032 HEREDITARY HEMORRHAGIC TELANGIECTASIA: PRESENTING AS AN UNUSUAL GASTRIC LESION. *(E.)* Tedesco, F. J.; Hosty, T. A.; Sumner, H. W. (Washington Univ. Sch. Med., St. Louis, Mo.). *Gastroenterology* 68(2):384-386, 1975.

3033 GASTRIC LYMPHOMAS: DIAGNOSIS AND THERAPEUTIC PROBLEMS. *(Ger.)* Rosch, W.; Hartwich, G. (Med. Clin. Polyclin., Univ. Erlangen-Nuremberg, Erlangen, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:839-841. 1973.

3034 GASTRIC LEIOMYOMA COMPLICATED BY PROFUSE INTRAABDOMINAL BLEEDING. *(Rus.)* Osingolts, S. L.; Khomut, I. M.; Ostrovskii, E. V.; Ponomarenko, E. I. (Kiev Med. Inst., USSR). *Klin. Khir.* (10): 47-48, 1974.

3035 GASTRIC LIPOMA IN AN AFRICAN. *(E.)* Wicks, A. C. B.; Thomas, G. E. (Harari Hosp., Salisbury, Rhodesia). *Am. J. Gastroenterol.* 62(6): 531-533, 1975.

3036 DIFFICULTIES IN THE DIFFERENTIAL DIAGNOSIS OF DIFFUSE LYMPHATIC HYPERPLASIA OF THE STOMACH. *(Ger.)* Gloor, F.; Hammer, B. (Canton. Hosp., St. Gallen, Switzerland). *Z. Gastroenterol.* 12(1):42-43, 1974.

3037 POLYADENOMATOSIS EN NAPPE OF THE ANTRUM. *(Fr.)* Hezez, G.; Lesbros, F.; Mathon, C.; Boulez, J.; Guillet, R. (no affil.). *Lyon Chir.* 70(6):418-419, 1974.

3038 EXPERIENCE WITH RATIONAL PARENTERAL FEEDING IN PATIENTS WITH STOMACH CANCER AFTER SURGERY. *(Rus.)* Glants, R. M.; Gnatyshak, A. I.; Bilynskii, B. T.; Iolych, M. M.: Osmolian, Zh. V. (Lvov Sci. Res. Inst. Hematol. Blood Transfus., USSR). *Klin. Khir.* (10):5-9, 1974.

3039 THE NATURE OF PAIN IN DIFFERENT STAGES OF GASTRIC CANCER AND PRECANCER. *(Rus.)* Martynenko, A. M. (Tula Reg. Oncol. Dispens., USSR). *Klin. Khir.* (10):1-5, 1974.

3040 PAPILLIFEROUS ADENOMAS OF THE STOMACH AND CHRONIC GASTRITIS WITH INTESTINAL METAPLASIA. *(Sp.)* Palma, F. (Princesa de Espana Hosp. Cent., Jaen, Spain). *Rev. Esp. Enferm. Apar. Dig.* 44(7):707-718, 1974.

3041 A CLINICAL EVALUATION OF POSTOPERATIVE ALKALINE REFLUX GASTRITIS. *(E.)* Bushkin, F. L.; Deford, J. W.; Wickbom, G.; Woodward, E. R. (Coll. Med., Univ. Florida, Gainesville). *Am. Surg.* 41(2):88-93, 1975.

3042 PHLEGMONOUS GASTRITIS. *(E.)* Miller, A. I.; Smith, B.; Rogers, A. I. (Univ. Miami, Sch. Med., Florida). *Gastroenterology* 68(2):231-238, 1975.

3043 ATROPHIC GASTRITIS. STRUCTURAL AND ULTRASTRUCTURAL ALTERATIONS, EXFOLIATIVE CYTOLOGY AND ENZYME CYTOCHEMISTRY AND HISTOCHEMISTRY, PROLIFERATION KINETICS, IMMUNOLOGICAL DERANGEMENTS AND OTHER CAUSES, AND CLINICAL ASSOCIATIONS AND SEQUELLAE. *(E.)* Glass, G. B. J.; Pitchumoni, C. S. (New York Med. Coll., N.Y.). *Hum. Pathol.* 6(2):219-250, 1975.

3044 EXPERIMENTAL STUDY OF THE PATHOGENESIS OF BLEEDING EROSIVE GASTRITIS INDUCED BY DRUGS. *(It.)* Trabucchi, E.; Ferla, G. F.; Napoli, P. A.; Bonomi, A. (1st Surg. Clin., Univ. Milan, Italy). *Arch. Ital. Chir.* 97(1):5-15, 1973.

3045 CAUSE OF THE INJURIOUS EFFECT OF ACETYLSALICYLIC ACID AND PHENYLBUTAZONE ON THE GASTRIC MUCOSA. *(Ger.)* Hahn, K. J. (Med. Clin., Univ. Heidelberg, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:828-830, 1973.

3046 RELATION BETWEEN GASTRIC HYDROCHLORIC ACID SECRETION AND CHRONIC GASTRITIS, AGE, SEX, AND DIAGNOSIS. *(Ger.)* Wolff, G.; Gutz, H. J.; Jacobasch, K. H. (Robert Rossle Clin., Berlin-Buch, Germany). *Dtsch. Z. Verdau. Stoffwechselkr.* 34(1): 1-8, 1974.

3047 LYSOLECITHIN IN THE GASTRIC CONTENTS. *(Ger.)* Clemencon, G.; Burgi, W.; Kaufmann, H. (Canton. Hosp., Olten, Switzerland). *Z. Gastroenterol.* 13(1):1-4, 1975.

3048 EARLY DIAGNOSIS OF CARCINOMAS OF THE STOMACH AND COLON. *(Ger.)* Mappes, G. (St. Vincentius Hosp., Karlsruhe, Germany). *Therapiewoche* 48(24):5675-5678, 1974.

3049 PRIMARY NEOPLASMS OF THE GASTRIC STUMP. *(Sp.)* Moreno, C.; Culebras Fernandez, J. M. (Jimenez Diaz Found., Madrid, Spain). *Rev. Esp. Enferm. Apar. Dig.* 44(8):785-796, 1974.

3050 CLINICAL TRIAL OF ULPIR GASTRO. *(Sp.)* Guemes Diaz, F.; Fernandez Navarro, M. (Dep. Gastroenterol., I.N.P., Madrid, Spain). *Rev. Esp. Enferm. Apar. Dig.* 44(8):837-844, 1974.

3051 ONE CASE OF MENETRIER'S DISEASE: FINDINGS FIVE YEARS AFTER TOTAL GASTRECTOMY. *(Fr.)* Hasbroucq, R.; Luez, J.; Modaine, L.; Huart, F.; Leduc, M.; Durieux, J. (no affil.). *Lille Chir.* 29(2):53-56, 1974.

3052 GASTRIC POLYPS: PROGNOSIS AND TREATMENT. *(Ger.)* Botticher, R.; Bunte, H.; Hermanek, P.; Rosch, W. (Surg. Clin., Univ. Erlangen-Nuremburg, Erlangen, Germany) *Dtsch. Med. Wochenschr.* 100(5): 167-170, 1975.

3053 LIPOMAS OF THE STOMACH. *(Rus.)* Suvorova, T. A.; Popova, Z. P.; Lukichev, P. M.; Kamonova, S. I. (Moscow Res. Inst. Roentgenol. Radiol., USSR). *Khirurgiia (Mosk.)* (3):57-60, 1973.

See also, 2866, 2877, 2879, 2890, 2893, 2895, 2943, 2954, 2957, 2959, 2988, 2992, 2995, 2998, 3003, 3060, 3079, 3198, 3199, 3306, 3671, 3672, 3690, 3694, 3734.

STOMACH

Peptic Ulcers

3054 INHIBITION OF GASTRIC SECRETION IN MAN BY ORAL ADMINISTRATION OF CALCITONIN. *(E.)* Ziegler, R.; Minne, H.; Hotz, J.; Goebell, H. (Cent. Intern. Med. Pediatr., Univ. Ulm, Germany). *Digestion* 11(1/2):157-160, 1974.

The sensitivity of the human stomach to oral calcitonin was studied. Gastric juice was collected from normal subjects at 30-min intervals, following calcitonin administration by stomach tube, and again after the administration of pentagastrin (0.8 µg/kg/hr i.v.) followed by calcitonin. Determinations were made for gastric acidity, pepsin content, and serum calcium. Synthetic human calcitonin induced a distinct inhibition of basal as well a pentagastrin-stimulated gastric secretion and pepsin output which was primarily a volume reduction. Acid and pepsin concentrations only slightly diminished. The inhibition was induced by 50-100 MRC U of human calcitonin or 1,400 MRC U of salmon calcitonin. Serum calcium levels did not change during the tests. Because of its therapeutic implications, an investigative trial of oral calcitonin administration in peptic ulcer disease is suggested.

3055 INTESTINAL CALCIUM ABSORPTION AFTER PARTIAL GASTRECTOMY. *(E.)* Nicolaou, A.; Alevizaki, C. C.; Ikkos, D. G.; Philokyprou, G. (Hippokrateion Hosp., Athens Univ. Med. Sch., Greece). *Am. J. Gastroenterol.* 62(6):516-525, 1974.

The intestinal absorption of calcium after gastrectomy was determined by a double radiocalcium tracer technique in 39 patients who underwent Billroth I or II operations for peptic ulcer between 4 months and 30 yr prior to the study. Each was given an oral dose of 140 mg labeled $CaCl_2$ in water along with a standardized light breakfast containing 80 mg calcium.

In all but 7 patients, fasting serum calcium, inorganic phosphate, and alkaline phosphatase, were measured and a d-xylose test was performed. The coefficient of true intestinal calcium absorption (a) varied between 7.7% and 5.0%. The mean $\log_{10}$ a-values of the gastrectomized patients (1.421) were significantly lower than those of the controls (1.536). The a-values were influenced by the interval between the operation and the study. Thus the mean $\log_{10}$ a-value of the early post-gastrectomy group (0-5 yr) was significantly lower (1.355) than that of the controls (1.530) or of the late post-gastrectomy group (6-30 yr, 1.478). By plotting a-values against patients' ages, age was ruled out as a factor in the difference between values of normal and gastrectomized patients. No significant correlations were found between a-values and inorganic phosphate or alkaline phosphatase values, or d-xylose absorption test results. Serum calcium showed a positive linear correlation for the 6-30 yr postgastrectomy group. Results confirm previous findings that reduced intestinal calcium absorption occurs in post-gastrectomy patients.

3056 SALIVARY SECRETION IN EVOLUTIVE AND QUIESCENT DUODENAL ULCER. *(E.)* Andre, F.; Descos, F.; Andre, C.; Lambert, R. (INSERM, Edouard-Herriot Hosp., Lyon, France). *Digestion* 11(1/2):98-104, 1974.

A comparison of salivary and pharyngeal secretions in healthy subjects and in patients with a duodenal ulcer was made to determine the significance of the outputs of organic and inorganic components of the saliva. Samples of the saliva stimulated by a gastric tube were collected from 9 healthy male volunteers (mean age 31 yr) and 9 male patients suffering from duodenal ulcer (mean age 33 yr). The volume was measured, and the constituents determined (fucose, total hexosamines, sialic acid, sulfate, proteins, free calcium and total calcium). In patients with an evolutive duodenal ulcer, the salivary outputs of fucose, hexosamines and sulfate were lower than in controls, and most of the calcium was found in the bound form. In patients with healed duodenal ulcer, the salivary outputs were greater than in controls, and the distribution pattern of calcium was the same as that in healthy subjects. It is suggested that the decreased glycoprotein secretion observed in the saliva of patients with an evolutive duodenal ulcer is a transient abnormality concomitant to the duodenal crater rather than a determining factor, and that the increased secretion measured in patients with healed ulcer could be related to enlargement of their salivary glands.

3057 PLASMA-GASTRIN AND ACID SECRETION IN PATIENTS WITH PEPTIC ULCERATION. *(E.)* Wesdorp, R. I. C.; Fischer, J. E. (Massachusetts Gen. Hosp., Boston). *Lancet* 2(7885):857-860, 1974.

In 132 patients with peptic ulceration, 101 with a duodenal ulcer and 31 with a gastric ulcer, the relationship between basal plasma-gastrin levels, basal intragastric pH, and basal and stimulated gastric-acid secretion was examined. The mean basal plasma-gastrin level for the 101 duodenal ulcer patients was 61 pg/ml, and was 93 pg/ml for gastric ulcer patients, compared to 54 pg/ml in 30 healthy controls. The mean basal intragastric pH was significantly lower in the duodenal ulcer patients (1.8) than in gastric ulcer patients (2.6). Throughout the study, basal plasma-gastrin appeared to be related to basal intragastric pH, but when the patients were grouped according to their pH, and plasma-gastrin values were compared, no significant differences were found between the groups. When they were grouped according to their basal gastric-acid secretion and their plasma-gastrin values compared, there was no significant difference between the groups and no inverse relationship. The results suggest that the duodenum may make a major contribution to basal circulating gastrin or that there may be some autonomy of gastrin release in duodenal-ulcer patients, since there was no decrease in plasma-gastrin levels as basal gastric-acid secretion increased. It also appears that basal acid secretion is independent of plasma-gastrin.

3058 DUODENAL ULCERATION IN ALLERGIC CHILDREN. *(E.)* Rebhun, J. (Dep. Med., Loma Linda Univ., Calif.). *Ann. Allergy* 34(3):145-149, 1975.

A diverse group of children with duodenal ulcerations and allergies was studied to determine whether the children's ulcer symptoms were functional or morphological. Children (43, 5-18 yr) suffering from a variety of allergies showed manifestations of ulceration classified as moderate in 30 cases, severe in 10, and intractable in three. X-ray findings showed 25 with definite ulceration, 12 with no definite crater but with spasm of the antrum and/or pylorus, and six with suspicious ulceration and spasm. Most of the ulcers responded to conventional ulcer therapy and were not present when x-rayed again 4-5 weeks later. The functional stomach ache often observed in allergic children might be explained by the organic changes. It is suggested that the chronic release of histamine-like substances, stress connected with a chronic illness, food sensitivities, and ulcerogenic drugs might be the factors affecting the allergic individuals so that the incidence of duodenal ulceration is greater among them than in the non-allergic children.

3059 THE ROLE OF SECRETIN IN THE INHIBITION OF GASTRIC SECRETION BY INTRADUODENAL ACID. *(E.)* Ward, A. S.; Bloom, S. R. (Sheffield R. Infirm., London, England). *Gut* 15(11):889-897, 1974.

The effect of intraduodenal acid and exogenous secretin on pentagastrin-stimulated gastric secretion was studied in 12 normal subjects and 23 patients with chronic duodenal ulceration. Pentagastrin (6 µg/kg/hr i.v.) was administered to normal subjects and duodenal ulcer patients followed by 40 ml of 0.1 N HCl labeled with 2% polyethylene glycol infused into the distal duodenum. Gastric samples were collected at 10-min intervals, and plasma secretin levels were

monitored using radioimmunoassay. Significant inhibition of gastric secretion occurred in the normal subjects (4.77-2.88 mEq/10 min) and duodenal ulcer patients (7.41-5.53 mEq/10 min). A significant rise in plasma secretin was observed in both groups (normals, 19.1-58.3 pg/ml; ulcer patients, 13.2-42.9 pg/ml), but there was a complete lack of correlation between the magnitude of the secretin response and the degree of gastric inhibition. Ten subjects received intraduodenal acid and a subsequent infusion of exogenous secretin (0.125-0.25 U/kg over 6 min). Gastric inhibition occurred after the acid instillation but not after the secretin infusion; plasma secretin levels rose to values greater than those produced by intraduodenal acid. The results provide evidence that secretin is not significantly involved in the inhibitory response to intraduodenal acid in man.

3060 STUDIES ON CHANGES IN LIPID PROFILES OF THE RAT GASTRIC MUCOSA WITH STRESS ULCERS. *(E.)* Slomiany, A.; Slomiany, B. L.; Horowitz, M. I. (New York Med. Coll., N.Y.). *Clin. Chim. Acta* 59(2): 215-226, 1975.

Changes in gastric mucosal neutral lipids, phospholipids, and glycolipids were studied in normal rats and in restrained rats which developed stress ulcers. Sprague-Dawley rats were fasted and immobilized in wire screens for 24 hr. The animals were killed, the stomachs removed and examined for ulceration, and the gastric mucosa scraped and prepared for analyses. Organic solvent extraction, silicic acid column, and thin-layer chromatography were employed to separate, and gas-liquid chromatography and spectrophotometry to quantitize the individual lipid components. Chemical analysis revealed profound alterations in the mucosal lipid profiles of rats with gastric mucosal erosions. Cholesterol esters were markedly elevated, 12.11 μM/100 mg lipids compared to 2.38 μM/100 mg lipids in controls. Cholesterol, free fatty acids, and phosphatidylethanolamine were lower in the extracts of ulcerated tissue, but the titer of lysophospholipids was about 8 times higher than in the controls. Lipid phosphorus was also elevated in stressed rats. The amount of neutral glycolipids was similar for both groups, but tetra- and oligohexoside ceramides, which were present in the gastric mucosa of the control rats, were virtually absent from the ulcerated mucosa. In contrast to the alterations in lipid profile, the total lipid weight/tissue preparation was very similar for the ulcerated and normal control groups. It is suggested that a shedding of membrane fragments could lead to a selective loss of certain lipid constituents, or that surface-active lipids may be causal agents in altering lipid composition of the mucosa.

3061 A COMMON DENOMINATOR IN THE PATHOGENESIS OF PEPTIC ULCERATION. *(E.)* Fiddian-Green, R. G. (Univ. Cape Town Med. Sch., South Africa). *S. Afr. J. Surg.* 12(3):163-172, 1974.

The gastric secretory responses to histamine were analyzed in 59 controls, 70 patients with duodenal ulcers and 32 patients with gastric ulcers to reassess data concerning ulcer pathogenesis. Gastric juice was collected by a nasogastric tube following i.v. infusion of histamine (0.04 mg/kg/hr), then measured for volume, titratable acidity, and concentration of Na^+, K^+, and Cl^-. Phenol red was used as an inert marker of pyloric reflux; sodium was used as a means of calculating volume of pyloric reflux within aspirated gastric juice. A statistically significant hypersecretion of gastric juice and an excessive degree of pyloric reflux were found in only a minority of patients. In the controls there was a significant positive correlation between the magnitude of the pyloric losses of acid and the bicarbonate concentration in the duodenum juice. There was no such correlation in either the patients with duodenal ulcers or the patients with gastric ulcers. The abnormal response to duodenal acidification in ulcer patients is the basis for a working hypothesis to account for the abnormalities in gastric secretory responses observed in patients with peptic ulcers.

3062 ACID HYPERSECRETION AND DUODENAL ULCERS PRODUCED BY CYSTEAMINE IN RATS. *(E.)* Groves, W. G.; Schlosser, J. H.; Mead, F. D. (Dep. Pharmacol., Smith Kline French Lab., Philadelphia, Pa.). *Res. Commun. Chem. Pathol. Pharmacol.* 9(3): 523-534, 1974.

The role of acid hypersecretion in the pathogenesis of cysteamine duodenal ulcer was studied in rats. Cysteamine, in various doses, was administered p.o. to 1-hr pylorus-ligated Charles River rats. The animals were autopsied 24 hr after the initial dose to determine the number and appearance of gastric and duodenal ulcers. A dose-related ulcerogenic effect was seen, and at 1 g/kg dose 1/2 the rats died. Cysteamine greatly increased acid secretion: 0.25 g/kg resulted in acid output 78% above controls; 1 g/kg resulted in acid output 277% above controls; the peak occurred 6-7 hr post-drug (0.5 g/kg) and was 662% above controls. Ulcers tended to occur selectively in the duodenum at low dose (88% incidence in duodenum, 24% incidence in stomach) but found equally often in stomach and duodenum at high dose. Their formation was associated with prolonged hypersecretion of highly acidic gastric juice thought to be the result of endogenous histamine release by cysteamine and/or its metabolite, cystamine.

3063 REPRODUCIBILITY OF PLASMA GASTRIN CONCENTRATION AND GASTRIC PEPSIN OUTPUT AFTER INSULIN-INDUCED HYPOGLYCAEMIA. *(E.)* Elder, J. B.; Walker, D. I.; Ganguli, P. C.; Gillespie, I. E. (R. Infirm., Manchester, England). *Scand. J. Gastroenterol.* 9(8):731-734, 1974.

Plasma gastrin concentration and gastric pepsin output following insulin-induced hypoglycemia were studied to establish the reproducibility of the responses. The tests were performed twice on 13 peptic ulcer patients. Gastric secretion was collected by nasogastric tube at 15-min intervals for 3 hr, and again after i.v. insulin (0.2 U/kg). Blood samples

were taken simultaneously. Peptic activity was assayed using radioiodinated human serum albumin as a tracer, plasma gastrin concentration by radioimmunoassay. Basal, peak, and 2-hr output of pepsin after insulin hypoglycemia values were reproducible (2-hr output most consistent). No significant difference was found in the data from the two tests. Values for serum gastrin concentration after insulin were widely scattered, but the overall pattern of the two tests was similar. Only the 2-hr gastrin output was found to be reproducible. The results cast doubt on the suitability of insulin as a stimulus for gastrin secretion.

3064 ACID SECRETION AND SERUM GASTRIN FOLLOWING INSULIN AND 2-DEOXY-D-GLUCOSE IN DUODENAL ULCER PATIENTS. *(E.)* Emas, S.; Svensson, S. O.; Dorner, M.; Kaess, H. (Dep. Surg. Clin. Physiol., Univ. Lund, Sweden). *Scand. J. Gastroenterol.* 9(7): 629-637, 1974.

The relationship of gastric acid response and serum gastrin concentration following insulin and 2-deoxy-D-glucose was studied in 30 patients with duodenal ulcer. Following administration of insulin (0.2 U/kg i.v.) or 2-deoxy-D-glucose (50 mg/kg i.v.) gastric secretion was collected at 15-min intervals. Serum gastrin concentration was determined by radioimmunoassay. The basal gastrin level varied but was unrelated to basal acid output or pH of the secretion. 2-Deoxy-D-glucose produced a higher peak acid response and peak gastrin level than insulin. The acid response to the stimulants was unrelated to the gastrin response. Insulin failed to increase gastrin level in three patients and 2-deoxy-D-glucose failed in one patient; both produced acid response in all patients. The absence of any relationship between gastrin level and acid secretion in the duodenal ulcer patients suggests that the acid response to insulin and 2-deoxy-D-glucose produced mainly by a vagal action on the parietal cells while gastrin exerts a permissive role.

3065 EFFECT OF ATROPINE ON INSULIN-STIMULATED GASTRIN RELEASE AND GASTRIC SECRETION OF ACID, PEPSIN, AND INTRINSIC FACTOR (IF). *(E.)* Schrumpf, E.; Vatn, M. H.; Semb, L. S. (Ulleval Univ. Hosp., Oslo, Norway). *Scand. J. Gastroenterol.* 9(7):665-669, 1974.

The effect of insulin and insulin combined with atropine on acid, pepsin, and intrinsic factor (IF) secretion was studied in duodenal ulcer patients to evaluate the cholinergic component of the insulin effect. Gastric secretion was collected for 1 hr basally and for 2 hr after insulin (0.2 IU/kg i.v.) or insulin combined with atropine (2 mg). The plasma gastrin level was determined radioimmunologically at 15-min intervals. In response to insulin, increased gastric secretion and increased plasma gastrin concentration were found. The simultaneous administration of atropine significantly reduced the secretion of acid, pepsin, and IF. Gastrin release was significantly enhanced. It is suggested that the insulin effect on acid, pepsin, and intrinsic factor secretion is cholinergic, whereas the insulin effect on gastrin release may be mediated through a non-cholinergic mechanism.

3066 PEPTIC ULCER DISEASE. *(E.)* Isenberg, J. I. (Univ. California Sch. Med., Los Angeles). *Postgrad. Med.* 57(1):163-174, 1975.

3067 ETIOLOGY AND PATHOGENESIS OF CHRONIC GASTRIC AND DUODENAL ULCER. *(Pol.)* Palasz, M. (Prov. Hosp., Warsaw, Poland). *Wiad. Lek.* 26(14): 1279-1283, 1974.

3068 PATHOGENESIS OF PEPTIC ULCER AND THE ADRENAL CORTEX. *(Rus.)* Boianovich, K. (Med. Acad., Lodz, Poland). *Klin. Med. (Mosk.)* 52(11): 38-43, 1974.

3069 THE INCIDENCE OF PEPTIC ULCER IN SOME OCCUPATIONAL GROUPS. *(Rus.)* Stoianova, Zh.; Stanchev, P.; Vlakhov, I. (Reg. Hosp., Pleven, Bulgaria). *Klin. Med. (Mosk.)* 52(7):79-83, 1974.

3070 RELATION BETWEEN THE OCCURRENCE OF PEPTIC ULCER AND TOBACCO SMOKING. *(Pol.)* Jedrychowski, W.; Popiela, T.; Magdon, M.; Scrozynska, K. (Acad. Med., Krakow, Poland). *Przegl. Lek.* 31 (6):603-609, 1974.

3071 DUODENOCOLONIC FISTULA IN A PATIENT WITH A DUODENAL ULCER. *(Rus.)* Zubarchuk, S. K.; Ishuk, A. G. (no affil.). *Klin. Med. (Mosk.)* 52(7):138-139, 1974.

3072 CLINICAL AND MORPHOLOGICAL FEATURES OF GASTRIC ULCERS IN ELDERLY PATIENTS. *(Rus.)* Kodolova, I. M.; Maiorov, V. M. (All-Union Sci. Res. Inst. Gastroenterol., Moscow, USSR). *Klin. Med. (Mosk.)* 52(1):105-110, 1974.

3073 VITAMIN B_1, B_6, PP AND C BALANCE IN PATIENTS WITH PEPTIC ULCER DISEASE UNDERGOING COMBINED TREATMENT. *(Rus.)* Litinskaya, E. V. (Clin. Hosp. No. 22, Kiev, USSR). *Vrach. Delo* (12):71-75, 1974.

3074 CHANGES IN THE CONTENT OF FREE AMINO ACIDS IN THE BLOOD OF ULCER PATIENTS AS RELATED TO THE CLINICAL COURSE AND TREATMENT. *(Rus.)* Ilika, V. G. (Chernovtsy Med. Inst., USSR). *Vrach. Delo* (12):64-69, 1974.

3075 KININ SYSTEM OF THE BLOOD IN PATIENTS WITH PEPTIC ULCER. *(Rus.)* Stepanova, I. V.; Vizir, A. D. (Zaporozhe Med. Inst., USSR). *Vrach. Delo* (10):21-22, 1974.

3076 STUDIES OF THE INCIDENCE OF ANTIBODIES TO PARIETAL CELLS IN SERUM OF PATIENTS WITH CHRONIC PEPTIC ULCER. *(Pol.)* Chojnacki, J. (Acad. Med., Lodz, Poland). *Wiad. Lek.* 27(21):1853-1856, 1974.

3077 GASTRIC SECRETION IN PATIENTS WITH CHRONIC ULCER AND THE ABILITY TO SECRETE BLOOD GROUP SUBSTANCES WITH SALIVA. *(Pol.)* Chojnacki, J. (Acad. Med., Lodz, Poland). *Wiad. Lek.* 27(22):1933-1936, 1974.

3078 CHANGES IN THE ACID-PRODUCING FUNCTION OF THE OPERATED STOMACH IN PEPTIC ULCER. *(Rus.)* Savelyev, V. S.; Umbrumyants, O. A. (N. I. Pirogov 2nd Moscow Med. Inst., USSR). *Khirurgiia (Mosk.)* (2):24-29, 1974.

3079 SECRETION OF GROUP-SPECIFIC SUBSTANCES WITH THE SALIVA AND GASTRIC JUICE IN PEPTIC ULCER AND CHRONIC GASTRITIS. *(Rus.)* Peleshchuk, A. P.; Kontesvich, I. A.; Nikula, T. D.; Polishchuk, I. A.; Shvediuk, V. M. (no affil.). *Vrach. Delo* (11):83-85, 1974.

3080 PANCREATIC FUNCTION IN PATIENTS WITH PEPTIC ULCER. *(Rus.)* Boger, M. M. (Inst. Cytol. Genet., Novosibirsk, USSR). *Klin. Med. (Mosk.)* 52(11):62-67, 1974.

3081 MEASUREMENT OF THE INTRAESOPHAGEAL pH IN PATIENTS WITH PEPTIC ULCER. *(Rus.)* Anakhsian, V. R.; Ermolov, A. S.; Kolesnikova, G. D.; Parina, M. M. (N. I. Pirogov 2nd Moscow Med. Inst., USSR). *Klin. Med. (Mosk.)* 52(11):43-47, 1974.

3082 HYPERCHOLESTEREMIA ASSOCIATED WITH CHANGES IN CHOLESTEROL AND PROTEIN METABOLISM IN PEPTIC ULCER. *(Rus.)* Misheni, I. D.; Furs, L. N.; Kurnevich, A. I. (Inst. Physiol., Minsk, USSR). *Dokl. Akad. Nauk Beloruss. SSR* 18(12):1128-1130, 1974.

3083 DUODENAL ULCERS PRODUCED BY NONSTEROIDAL ANTIINFLAMMATORY COMPOUNDS PLUS BILE DUCT LIGATION. *(E.)* Robert, A.; Nezamis, J. E.; Lancaster, C. (Dep. Exp. Biol., Upjohn Co., Kalamazoo, Mich.). *Fed. Proc.* 34(3):442, 1975.

3084 EFFECT OF DOCA ON THE DEVELOPMENT OF EXPERIMENTAL HISTAMINE GASTRIC ULCERS. *(Rus.)* Liashko, N. A.; Melnik, L. A.; Kosenko, A. F.; Kushnir, V. E. (Inst. Physiol., T. H. Shevchenko Univ., Kiev, USSR). *Vrach. Delo* (10):16-20, 1974.

3085 THE PROTECTIVE EFFECT OF VAGOTOMY AND PYLOROPLASTY ON THE INDUCTION OF STRESS ULCERS IN EXPERIMENTAL ANIMALS. *(Ger.)* Ruppell, V.; Nusser, C. J. (Surg. Clin., Univ. Wurzburg, Germany). *Z. Gastroenterol.* 12(5):307-314, 1974.

3086 EFFECT OF PEPSTATIN, A SPECIFIC PROTEASE INHIBITOR, ON THE EXPERIMENTAL PEPTIC ULCERS. *(E.)* Sung, J. L.; Chang, F. M.; Yu, J. Y. (Dep. Intern Med., Natl. Taiwan Univ., Taipei). *J. Formosan Med. Assoc.* 73(4):211-219, 1974.

3087 EFFECT OF PROLONGED ANTICHOLINERGIC TREATMENT ON GASTRIC ACID SECRETION STIMULATED BY HISTAMINE AND PENTAGASTRIN. *(Fr.)* Ligny, G. (Munic. Hosp., Charleroi, Belgium). *Agressologie* 15(2):151-164, 1974.

3088 DOUBLE-BLIND TESTS OF HYOSCIN-N-BURYLBROMIDE (BUSCOPAN) FOR ALLEVIATING PAIN IN PATIENTS WITH GASTRIC ULCERS. *(Ger.)* Sieg, H. (Munic. Hosp., Rendsburg, Germany). *Z. Gastroenterol.* 12(4):235-238, 1974.

3089 SECRETIN AS A POSSIBLE THERAPEUTIC AGENT IN PEPTIC ULCER. *(Rus.)* Geller, L. I.; Glinskaya, T. P.; Kozlova, Z. P. (Kiev Inst. Postgrad. Med., USSR). *Vrach. Delo* (12):55-58, 1974.

3090 SURGICAL TREATMENT OF GASTRIC AND DUODENAL ULCERS. *(Rus.)* Rusanov, A. A. (no affil.). *Vestn. Khir.* 113(11):19-25, 1974.

3091 VAGOTOMY AND DOUBLE PYLOROPLASTY FOR PEPTIC ULCER. *(E.)* Hines, J. R.; Geurkink, R. E.; Kornmesser, T. A.; Wikholm, L.; Davis, R. P. (Northwest. Univ. Med. Sch., Chicago, Ill.). *Ann. Surg.* 181(1):40-46, 1975.

3092 THE FEASIBILITY OF PREDICTING THE EFFECT OF SURGICAL VAGOTOMY. *(Rus.)* Postolov, P. M.; Naumov, B. A. (I. M. Sechenov 1st Moscow Med. Inst., USSR). *Vestn. Khir.* 113(9):138-141, 1974.

3093 EFFECT OF BENZOHEXONIUM ON GASTRIC SECRETION BEFORE AND AFTER SELECTIVE VAGOTOMY COMBINED WITH DRAINAGE AND SPARING PROCEDURES. *(Rus.)* Babichenko, M. E.; Babichenko, G. E. (Kiev Med. Inst., USSR). *Klin. Khir.* (10):9-12, 1974.

3094 ENDOSCOPIC EXAMINATION OF THE STOMACH AFTER VAGOTOMY AND PYLOROPLASTY. *(It.)* Belsasso, E.; Visintini, E.; Adovasio, R.; Caenazzo, E. (Osp. Maggiore, Trieste, Italy). *Chir. Gastroenterol.* 8(1):28-34, 1974.

3095 EXTRAGASTRIC LIBERATION OF GASTRIN IN NORMAL SUBJECTS AND PATIENTS WITH DUODENAL ULCERS OR AFTER PARTIAL STOMACH RESECTION AND BILLROTH I PROCEDURE. *(Ger.)* Hausamen, T. U.; Fritsch, W. P.; Rick, W.; Kleybrink, H.; Schacht, U. (1st Med. Clin. A., Univ. Dusseldorf, Germany). *Z. Gastroenterol.* 12(4):265-268, 1974.

3096 GASTRIC SECRETION AFTER VAGOTOMY IN CONNECTION WITH ECONOMIC GASTRIC RESECTION IN PATIENTS WITH DUODENAL ULCERS. *(Rus.)* Postolov, P. M.; Naumov, B. A.; Makarova, V. N. (I. M. Sechenov 1st Moscow Med. Inst., USSR). *Khirurgiia (Mosk.)* (2):42-47, 1974.

3097 CHANGES OF THE ELECTROCARDIOGRAM FOLLOWING SUBDIAPHRAGMATIC VAGOTOMY IN PATIENTS WITH PEPTIC ULCER. *(Rus.)* Nechiporuk, V. M.; Ryzanovskaya, V. M. (Vinnitse Med. Inst., USSR). *Vrach Delo* (11):81-83, 1974.

3098 STATE OF THE CARDIOVASCULAR SYSTEM IN PATIENTS WITH PEPTIC ULCER BEFORE AND AFTER RESECTION OF TWO-THIRDS OF THE STOMACH. *(Rus.)* Ryzhkova, K. G. (Kiev Inst. Postgrad. Med., USSR). *Vrach Delo* (12):58-60, 1974.

3099 ANTICHOLINERGICS: DO THEY WORK IN PEPTIC ULCER? *(E.)* Ivey, K. J. (R. Prince Alfred Hosp., Camperdown, Australia). *Gastroenterology* 68(1):154-166, 1975.

3100 LONG-TERM RANDOMIZED PROSPECTIVE COMPARISON OF FINNEY AND HEINEKE-MIKULICZ PYLOROPLASTY IN PATIENTS HAVING VAGOTOMY FOR PEPTIC ULCERATION. *(E.)* Thompson, B. W.; Read, R. C. (VA Hosp., Little Rock, Arkansas). *Am. J. Surg.* 129(1):78-81, 1975.

3101 SURGICAL TREATMENT OF LATE POSTGASTRECTOMY SYNDROMES. *(E.)* Reber, H. A.; Way, L. W. (Univ. California Sch. Med., San Francisco). *Am. J. Surg.* 129(1):71-77, 1975.

3102 GASTRIC ACID AND DUODENOGASTRIC REFLUX. *(E.)* Kallner, A. (Serafim Hosp., Karolinska Inst., Stockholm, Sweden). *Lancet* 1(7902):338, 1975.

3103 BLEEDING PEPTIC ULCER. *(E.)* Tandon, R. K.; Tsapogas, M. J. (Albany Med. Coll., N.Y.). *NY State J. Med.* 75(1):35-38, 1975.

3104 ACUTE GASTROINTESTINAL ULCERS AS SEQUELAE OF SURGERY: 18 CASES. *(Fr.)* Bessot, M.; Lorenzini, C.; Mauuary, G.; Ravey, M.; Voiry, J. P.; Laxenaire, M. C.; Frisch, R. (Univ. Hosp. Cent., Nancy, France). *Ann. Med. Nancy* 13:1443-1450, 1974.

3105 THE USE OF BENZOHEXONIUM IN THE TREATMENT OF POSTVAGOTOMY COMPLICATIONS. *(Rus.)* Cherniakevich, S. A.; Groisman, S. D. (N. I. Pirogov 2nd Moscow Med. Inst., USSR). *Khirurgiia (Mosk.)* (4):111-118, 1974.

See also, 2535, 2553, 2555, 2876, 2890, 2894, 2948, 2951, 2957, 2988, 2992, 2995, 3011, 3018, 3020, 3022, 3047, 3050, 3345, 3462, 3649, 3689.

SMALL INTESTINE

3106 DUODENAL DUPLICATION AND ACUTE PANCREATITIS: A RARE COMBINATION. *(Fr.)* Meyer, C.; Otteni, F.; Kohler, J. J.; Hollender, L. F. (Univ. Hosp. Cent., Strasbourg, France). *Lyon Chir.* 70(4):255-256, 1974.

At laparotomy, radiological examination of the biliary tract of a 14-yr-old girl with acute pancreatitis showed a normal common bile duct and excellent flow into the duodenum, but some of the contrast medium escaped to the left side and outlined an area inside the pancreas. A bile-filled swelling the size of an adult fist was found in the head of the pancreas. It appeared to be either a cystic diverticulum of a bile duct or a pancreatic cyst. After performing a cystoduodenostomy, histological examination of the wall of the cyst revealed a duodenal mucosa surrounded by a layer of muscle, suggesting that this cavity resulted from duodenal duplication. It is suggested that this duplication compressed the pancreatic duct. The absence of signs referable to the biliary tract can be explained by communication of the opening at the bottom of the duplication with the lower bile duct and not with the pancreatic duct. Bile flowed into the diverticulum which acted as a reservoir. The patient is alive and well 17 months after surgery.

3107 PRIMARY INTESTINAL LYMPHOMA WITH PARAPROTEINEMIA. *(E.)* Shahid, M. J.; Alami, S. Y.; Nassar, V. H.; Balikian, J. B.; Salem, A. A. (American Univ. Hosp., Beirut, Lebanon). *Cancer* 35(3):848-858, 1975.

Five of 25 cases of primary intestinal lymphoma seen at the American University Hospital in Beirut in a 4-yr period are described, 4 of which (16%) were associated with immunoglobulin (Ig) abnormality. The main clinical features included abdominal pain, diarrhea, and marked weight loss, together with radiologic and some laboratory findings suggestive of malabsorption, with low levels of serum protein, serum albumin, serum cholesterol, and often serum calcium. Laparotomy performed in 4 cases revealed dilatation of the small intestine, with mesenteric node enlargement. In these 4 instances there was a definite histologic evidence of malignant lymphoma, either

initially or later in the course of the disease. A characteristic feature was the diffuse infiltration of the intestinal mucosa with plasma cells, which in the deeper layers became progressively atypical and were mixed with histiocytes and giant cells. A similar infiltrate was seen in the mesenteric nodes. Immunoelectrophoresis showed the pattern of IgA heavy chain disease. It is suggested that IgA heavy chain disease is a variant of primary intestinal lymphoma and not a separate disease entity. From these cases, it may be stated that primary intestinal lymphoma with malabsorption, as seen in the Middle Eastern countries, represents a definite entity with characteristic clinical, radiologic, and histologic features.

3108 EXTRINSIC DUODENAL OBSTRUCTION IN INFANTS AND CHILDREN. *(E.)* Tryfonas, G.; Young, D. G. (R. Hosp. Sick Child., Glasgow, Scotland). *Br. J. Surg.* 62(2):125-129, 1975.

The case records of 34 infants and children (1 day to 11 yr) admitted to hospital during a 5-yr period with signs or symptoms due to extrinsic duodenal obstruction are reviewed. All the neonates had shown signs of an upper intestinal obstruction and all had vomited bile-stained fluid. Only two infants failed to pass meconium and most had passed changed stools. All the older infants and children, except one, had normal bowel habits until the acute episode. X-rays of the abdomen in the erect posture were not always helpful in making the diagnosis. When straight x-rays did not clarify the position, radiological studies using a contrast medium were made. An abnormal but variable pattern of gas distribution throughout the gut with fluid levels in the stomach, and sometimes in the duodenum and the small bowel when volvulus had occurred, were the most common findings. In infants or children with malrotation the duodenojejunal flexure was displaced to the right and the proximal small bowel was lying predominantly on the right side of the peritoneal cavity rather than on the left. Three types of malrotation were identified: 1) malrotation with bands; 2) malrotation with volvulus of the midgut; and 3) superior mesenteric artery obstruction. All the patients in this group were considered to require operation. Five patients died, one just after admission and four during the first 24 hr after operation. The factors which interrupt the normal rotation of the gut remain obscure. In only one of the present series was a clear etiological factor present, namely, a diaphragmatic hernia. It is emphasized that speed is essential in the diagnosis of this condition because there is no external evidence to indicate which infants have volvulus and this complication may result in gangrene of the small bowel.

3109 THE ABILITY OF AN ELEMENTAL DIET TO SUPPORT NUTRITION AND ADAPTATION IN THE SHORT GUT SYNDROME. *(E.)* Voitk, A. J.; Crispin, J. S. (Dep. Surg., Univ. Manitoba, Winnipeg, Canada). *Ann. Surg.* 181(2):220-225, 1975.

The usefulness of the elemental diet in the short gut syndrome was investigated using 80 adult male Sprague-Dawley rats which had been subjected to 85% enterectomy (sufficient to cause major nutritional problems) or jejunal biopsy. After recovery, the rats in each group were randomly fed either elemental diet or rat chow. Hemoglobin, albumin, and total protein were determined at the time of operation and at sacrifice, 8 weeks later. A daily record was also kept of weight, food and water consumption, and amount and character of stool. Biopsied rats gained more weight with elemental diet than chow (22% *versus* 18%). Resection produced greater weight loss than biopsy and slower gain. The failure to gain was most marked in elemental diet rats, significantly less than in the chow group by week 2. A fall in hemoglobin, protein, and albumin was seen in all rats: neither the fall nor difference between the groups was significant. Enterectomized chow rats ate 22% more than their controls, whereas the elemental diet group ate 10% less. Increase in bowel length after resection, equally divided between jejunum and ileum, was 21% with elemental diet and 26% with chow. Gut diameter after resection increased 104% and 98% with chow and elemental diet, resp. Villus height increased 65% in the jejunum of both enterectomized groups and 85% and 78% with chow and elemental diet, resp., in the ileum. Changes in gut length, diameter and villus height were significant in each group but not between groups. It is concluded that elemental diet can support nutrition in the adaptive phase of the short gut syndrome but less well than normal food.

3110 METASTATIC SEEDING ALONG THE SMALL BOWEL MESENTERY. ROENTGEN FEATURES. *(E.)* Meyers, M. A. (New York Hosp.-Cornell Univ. Med. Cent., N.Y.). *Am. J. Roentgenol. Radium Ther. Nucl. Med.* 123(1):67-73, 1975.

The characteristic roentgen features in eight cases of proved malignant seeding along the small bowel mesentery are discussed and illustrated. The anatomic features of the small bowel mesentery and the pathways of flow of ascitic fluid along its peritoneal recesses determine the deposition and growth of seeded metastases. Seeded deposits lodge particularly within the lower recesses of the small bowel mesentery and are reflected by typical changes involving distal ileal loops or the cecum. These changes are characterized by palisading, arcuate scalloped deflections or gross mass displacement of distal small bowel loops in the right lower quadrant, or by extrinsic indentations upon the medial and inferior contours of the cecum. Associated desmoplastic reaction may result in tethering of mucosal folds and angulated fixation of bowel loops. The most extreme fibrous reaction was encountered in metastatic seeding from pancreatic carcinoma and mucin-producing gastric carcinoma. In the male, the primary carcinoma most commonly arises in the gastrointestinal tract and in the female, the genital system. It is concluded that the small bowel alterations are not difficult to distinguish from other common disease states. The lack of inflammatory features and the characteristic spectrum of changes help in the differential diagnosis from

regional enteritis, tuberculosis, amebiasis, and peritoneal adhesions.

3111 ENDOSCOPIC POLYPECTOMY IN THE DUODENUM. ITS COMPLICATIONS BY PANCREATITIS. *(E.)* Apler, E. I.; Foroozan, P.; Johnson, R. B.; Haubrich, W. S. (Scripps Clin. Res. Found., La Jolla, Calif.). *Gastrointest. Endosc.* 21(3):119-122, 1975.

The endoscopic removal of 9 of 12 duodenal polypoid lesions identified during an 18-month period is discussed. These lesions included epithelial and Brunner's gland adenomas, villous adenomas, and a carcinoid tumor. In all but one case, the lesion was first noted in upper gastrointestinal radiographs. The lesions were removed using the snare and electrocoagulation method, with intermittent current application. An attempt was made to avoid contact with the opposite duodenal wall. In two cases, the histopathological findings suggested that the procedure may have been of definite benefit. Two patients whose postbulbar adenomas were removed developed acute transient pancreatitis from which they recovered completely; their cases are presented in detail. The occurrence of acute pancreatitis in two members of this small group of patients may be cause for some hesitation with respect to future procedures. Both of these episodes involved lesions situated in the second portion of the duodenum which were endoscopically distinct and apart from the duodenal papilla. The following broad indications were drawn from this experience: 1) removal of a pedunculated lesion of the bulb which has some evidence of mucosal irregularity may be justified; and 2) masses which are submucosal and appear to be covered by normal duodenal lining might best be left alone.

3112 PANCREATIC ADAPTATION TO SUBTOTAL RESECTION OF THE SMALL INTESTINE IN INFANTS AND CHILDREN. *(Ger.)* Niessen, K. H.; Brugmann, G.; Osswald, P.; Schmidt, K.; Flach, A. (Pediatr. Clin., Univ. Tubingen, Germany). *Klin. Wochenschr.* 52(16):796-798, 1974.

The secretin-pancreozymin test was used to study pancreatic function in 4 patients who had undergone subtotal resection of the small intestine 1 day to 1 month after birth for necrotizing enteritis (2 cases), volvulus of the small intestine (1 case), or gastroschisis (1 case). When calculated on the basis of body weight, the volume of pancreatic secretion and the bicarbonate output were increased in 2 of the 4 patients. In addition, 1 patient had an elevated trypsin output. However, when the absolute values of pancreatic secretion in these children were compared with those of 23 children of the same age who were of normal height and weight, both these values and values calculated on a body weight basis fell in the normal range. It is suggested that evidence of pancreatic hyperfunction in patients who have undergone subtotal resection of the small intestine, as in patients with celiac disease, is due to malnutrition in these children.

3113 CYTOPHOTOMETRIC AND AUTORADIOGRAPHIC STUDIES OF THE FUNDAL GLANDS OF THE GASTRIC MUCOSA AFTER EXTENSIVE RESECTION OF THE SMALL INTESTINE. *(Rus.)* Zufarov, K. A.; Baibekova, E. M.; Pechnikov, L. V. (Tashkent Med. Inst., USSR). *Arkh. Anat. Gistol. Embriol.* 67(11):18-23, 1974.

Cytophotometric and autoradiographic studies were conducted on male albino rats after an extensive resection of the small intestine to measure DNA content in the nuclei of the chief and parietal cells of the fundic glands, RNA content in the cytoplasm of the chief cells, and ^{3}H-thymidine incorporation in all the epithelial cells of the gastric mucosa. The findings indicate that by the end of the first month, the pepsinogen-forming function of the fundic cells was significantly inhibited and partially replaced by mucus secretion, which was indicated by the drop in the DNA content in the cytoplasm of the chief cells by 16% and a twofold increase of the goblet cells, and decrease in the chief cells by 37%. The adaptive function was taken over by the nuclei of the chief and parietal cells of the stomach which was evidenced by an increase in the DNA content in these cells and a more active DNA synthesis in the parietal cell nuclei. Three months after the operation, enhanced DNA synthesis and proliferation of the chief cells indicated the postoperative tendency to regulate protein metabolism and rectify the deficiency of the pepsinogen secreting cells. It is suggested that resection of the small intestine involves an adaptive rearrangement resulting in enhanced synthesis of nucleic acids in the specialized cells of the fundic glands, in the increase of their number and mitotic activity.

3114 LEIOMYOMAS OF THE SMALL INTESTINE: TWO CASES DISCOVERED BY ARTERIOGRAPHY. *(Fr.)* Labrune, M.; Brault, B.; Rey, J. L.; Chaput, J. C.; Gaux, J. C. (Antoine-Beclere Hosp., Clamart, France). *Ann. Radiol. (Paris)* 17(5):491-495, 1974.

The value of arteriography in the localization of leiomyomas of the small intestine was studied. Two patients presenting with recurrent digestive hemmorrhage showed arteriographic evidence of a benign tumor: normal or enlarged afferent artery; tumor formed from a mass of harmonious neovascularization; homogenous opacity of the parenchyma; normal afferent vein; spongy aspect to the tumor; and massive venous return when the leiomyoma is associated with an angiomatous component. In one instance, the tumor was located on the duodenum, and in the other it was located on the ileocecum. Treatment was by limited resection. Surgical exploration is necessary to determine the specific histologic type. Because the tumors tend to develop outside the intestinal lumen, barium opacification may produce normal appearance, although there may be signs of extrinsic compression, as in one of the observed cases. It is concluded that only arteriography can reveal the existence and position of these hypervascular tumors.

3115 THE ROENTGENOLOGIC SPECTRUM OF SMALL INTESTINAL CARCINOID TUMORS. *(E.)* Bancks, N. H.; Goldstein, H. M.; Dodd, G. D., Jr. (Univ. Texas Med. Sch., Houston). *Am. J. Roentgenol. Radium Ther. Nucl. Med.* 123(2):274-280, 1975.

The roentgenologic features of 18 small intestinal carcinoid tumors were analyzed. The patients, 8 of whom were female, ranged in age from 40-69 yr. The primary neoplasm arose in the ileum in 17 cases and in the jejunum in 1 case. The most common clinical symptom was crampy abdominal pain generally associated with some degree of intestinal obstruction. Roentgenologic appearances varied from solitary or multiple submucosal nodules to extensive mesenteric desmoplasia without demonstration of a tumor mass. Some manifestation of the desmoplastic reaction was observed in at least 13 patients. The spectrum of roentgenologic features secondary to carcinoid tumors was more diverse than with most gastrointestinal neoplasms, primarily because of the variety of growth patterns and the tissue reactions incited by this disease. Thus, carcinoid tumors should be considered in the differential diagnosis of both inflammatory and neoplastic small bowel lesions. In particular, when there is evidence of solitary or multiple submucosal nodules and/or when manifestations of mesenteric disease are present, carcinoid tumor is a likely diagnosis. Angiographically, the most common features of carcinoid tumors are kinking, irregularity, or obstruction of distal intra-mesenteric arteries. Careful small intestinal examination is essential, since a barium study often provides the first or only opportunity to suggest diagnosis. Moreover, prognosis appears to be directly correlated with the tumor size and resectability, and preoperative consideration of the diagnosis is important for safe anesthesia in patients with elevated vasoactive hormonal levels.

3116 DUODENAL PSEUDOPOLYP - THE FLEXURE FALLACY. *(E.)* Nelson, J. A.; Sheft, D. J.; Minagi, H.; Ferruci, J. T., Jr. (VA Hosp., San Francisco, Calif.). *Am. J. Roentgenol. Radium Ther. Nucl. Med.* 123(2):262-267, 1975.

Several patients with a persistent roentgenographic contour defect at the superior flexure of the duodenum were surgically studied and followed for periods of 6 months to 15 yr. The typical finding was a characteristic filling defect with prominent folds in the duodenal bulb and no evidence of ulcer or mucosal erosion; the descending duodenum was normal. The explanation of the phenomenon appeared to be a heaping up of redundant loose mucosa on the inner aspect of the duodenal flexure; as the tubular muscle wall of the gut turned, the outer mucosa was stretched while the inner folds at the flexure were compressed and piled up. The phenomenon appeared to be both benign and rather common, occurring in males and females within a broad range of ages. Radiologists should become aware of this change, because it is so characteristic in location and appearance that further, more aggressive diagnostic work-up seems unwarranted.

3117 INTESTINAL NEUROFIBROMATOSIS. *(E.)* Hakami, M.; Mosavy, S. H.; Juzdani, M.; Vakhshuri, P. (Isfahan Univ. Sch. Med., Iran). *J. Abdom. Surg.* 17(3):65-66, 1975.

3118 A CASE OF RECKLINGHAUSEN'S DISEASE WITH CONCOMITANT POLYPOSIS OF THE SMALL INTESTINE. *(Pol.)* Indulska, M.; Pawlak, J. (Brudzinski Hosp., Lodz, Poland). *Przegl. Lek.* 31(6):640-642, 1974.

3119 PEUTZ-JEGHER'S SYNDROME WITH PSYCHIATRIC AND NEUROLOGICAL SYMPTOMS. *(Ger.)* Pesendorfer, F.; Stellamor, K. (Rudolf Found. Hosp., Vienna, Austria). *Z. Gastroenterol.* 13(2):343-347, 1975.

3120 BENIGN SMALL BOWEL TUMOR. *(E.)* Wilson, J. M.; Melvin, D. B.; Gray, G.; Thorbjarnarson, B. (New York Hosp.-Cornell Univ. Med. Cent., N.Y.). *Ann. Surg.* 181(2):247-250, 1975.

3121 TUMORS OF THE SMALL INTESTINE. *(E.)* Croom, III, R. D.; Newsome, J. F. (Univ. North Carolina Sch. Med., Chapel Hill). *Am. Surg.* 41(3):160-167, 1975.

3122 VILLOUS TUMORS OF THE DUODENUM. *(E.)* Kutin, N. D.; Ransom, J. H. C.; Gouge, T. H.; Localio, S. A. (New York Univ. Med. Cent., N.Y.). *Ann. Surg.* 181(2):164-168, 1975.

3123 LEIOMYOSARCOMA OF SMALL INTESTINE (PRESENT IN HERNIAL SAC). *(E.)* Krishna Rao, C. V.; Vijaya Simha, C. (Kurnool Med. Coll., India). *Indian J. Surg.* 36(4):163, 1974.

3124 MALIGNANT TUMORS OF THE JEJUNUM. *(It.)* Boscaino, N.; Lombardi, A. R. (Ascalesi Hosp., Naples, Italy). *Policlinico [Chir.]* 80(3):142-161, 1973.

3125 PRIMARY CARCINOMA OF THE DUODENAL BULB. *(Hun.)* Vitaszek, L.; Juhasz, L. (Surg. Ward, Bekescsaba City Hosp., Hungary). *Magy. Sebesz.* 27(5):310-312, 1974.

3126 INTRAMURAL HEMATOMA OF THE SMALL INTESTINE CAUSED BY ANTICOAGULANTS. *(Fr.)* Huguier, M. (Rothschild Hosp., Paris, France). *Rev. Fr. Gastroenterol.* (97):7-12, 1974.

3127 NONCHROMAFFINIC PARAGANGLIOMA OF THE JEJUNUM. *(Sp.)* Suarez Savio, O.; Buviola Gonzalez, B.; Gallo Cortes, F.; Gomez Barry, H.; Arango Rodriguez, M. M.; Alvarez Rodriguez, N. (Joaquin Albarran Hosp., Havana, Cuba). *Rev. Dub. Cir.* 13(5):497-505, 1974.

3128 EOSINOPHILIC GRANULOMA OF THE ILEUM. *(E.)* Myers, A.; Humphreys, D. M.; Williamson, R. C. N. (R. Berkshire Hosp., Reading, England). *Postgrad. Med. J.* 51(592):99-102, 1975.

3129 GALL STONE ILEUS. *(E.)* Sachdeva, H. S.; Bose, S. M.; Mann, K. S.; Wig, J. D. (Postgrad. Inst. Med. Educ. Res., Chandigarh, India). *Indian J. Surg.* 36(6):240-241, 1974.

3130 A CASE OF ACUTE INTESTINAL OBSTRUCTION DUE TO ENTEROLITHIASIS. *(E.)* Muthu, S.; Rao, R. N. (Madras Med. Coll., India). *Indian J. Surg.* 36(2):82-83, 1974.

3131 DUODENAL OBSTRUCTIONS IN NEWBORNS. *(Ger.)* Wilk, F.; Hartl, H.; Hohenauer, L. (Prov. Child. Hosp., Linz, Austria). *Wien. Med. Wochenschr.* 124(5):82-85, 1975.

3132 DUODENAL DIVERTICULA: COMMENTS ON SIXTY CASES. *(Sp.)* Rodriguez Cuartero, A.; Pelaez Redondo, J. (Fac. Med., Univ. Granada, Spain). *Rev. Clin. Esp.* 133(2):89-100, 1974.

3133 SIDEROBLASTIC ANAEMIA AND JEJUNAL DIVERTICULOSIS. *(E.)* Child, J. A.; Mallinson, C. N. (St. Bartholomew's Hosp. Med. Coll., London, England). *Guys Hosp. Rep.* 122(3/4):245-258, 1973.

3134 PERFORATION OF THE SMALL INTESTINE FOLLOWING ABSORPTION OF POTASSIUM CHLORIDE TABLETS. *(Fr.)* Morice, A.; Chartier, P. (no affil.). *Ouest Med.* 27(9):875-879, 1974.

3135 DUODENAL PERFORATION: A RARE COMPLICATION OF NEONATAL NASOJEJUNAL TUBE FEEDING. *(E.)* Sun, S. C.; Samuels, S.; Lee, J.; Marquis, J. R. (Child. Hosp., Newark, N.J.). *Pediatrics* 55(3): 371-375, 1975.

3136 FUNCTIONAL INTESTINAL ISCHEMIA (PERFUSION ISCHEMIA). *(Ger.)* Baas, E. U. (1st Med. Clin., Univ. Mainz, Germany). *Dtsch. Med. Wochenschr.* 100(14):764-765, 1975.

3137 TREATMENT OF INTESTINAL INFARCTS. *(Fr.)* Lagneau, P.; Cormier, J. M. (St. Joseph Hosp., Paris, France). *Rev. Prat.* 23(31):2853-2859, 1973.

3138 INTRAMURAL INTESTINAL HAEMORRHAGE: A COMPLICATION OF ANTICOAGULANT THERAPY. *(E.)* Hale, J. E. (Westminster Hosp., London, England). *Postgrad. Med. J.* 51(592):107-110, 1975.

3139 LOCALIZED NECROSIS OF THE INTESTINAL MUCOSA AS A RESULT OF TEMPORARY INTUSSUSCEPTION. *(Ger.)* Heine, W.; Tessmann, D.; Stolpe, H. J.; Richter, I. (Dep. Med., Univ. Rostock, Germany). *Zentralbl. Chir.* 99(34):1081-1083, 1974.

3140 INTESTINAL STENOSIS (A CLINICOPATHOLOGICAL STUDY). *(E.)* Grewal, R. S.; Mishra, S. D.; Pratap, V. K.; Raj, B.; Gupta, S. C. (Med. Coll., Meerut, India). *Indian J. Surg.* 36(7):261-265, 1974.

3141 THE ETIOLOGY OF NONSCLEROSING ILEITIS (ENTERITIS). *(Ger.)* Hardt, H.; Rohrl, C.; Gajdasic, T.; Wirth, K. (Cent. Radiol., Justus Liebig Univ., Giessen, Germany). *Z. Gastroenterol.* 13(2):323-330, 1975.

3142 DUODENAL MOTOR DISORDERS. *(Rus.)* Griaznova, N. A.; Salman, M. M.; Shirokova, K. I. (I. M. Sechenov 1st Moscow Med. Inst., USSR). *Sov. Med.* (11):122-125, 1974.

3143 INTESTINAL COMPLICATIONS OF RADIOTHERAPY AND THEIR TREATMENT. *(Ger.)* Mlynek, H. J.; Hartig, W.; Strassburger, P.; Engel, C. (Surg. Clin., Karl Marx Univ., Leipzig, Germany). *Zentralbl. Chir.* 99(31):961-966, 1974.

3144 THERAPEUTIC, METABOLIC, AND ELECTROLYTIC PROPHYLAXIS OF POSTTRAUMATIC GASTROINTESTINAL DISORDERS: THE PLACE OF RESUSCITATION IN POSTTRAUMATIC DISORDERS IN INTESTINAL TRANSIT. *(Fr.)* Roujas, F. (Henri Mondon Hosp., Creteil, France). *Ann. Anesthesiol. Fr.* 15(Suppl. 1):98-108, 1974.

3145 VOLVULUS OF THE SMALL INTESTINE AND TREITZ'S HERNIA. *(Rus.)* Pestova, Z. V. (Velikoustiug Hosp., USSR). *Khirurgiia (Mosk.)* (12):97-98, 1974.

3146 END-TO-SIDE AND END-TO-END JEJUNOILEAL BYPASS FOR INTRACTABLE OBESITY. *(E.)* Bellamah, H. F. (no affil.). *J. Abdom. Surg.* 17(3): 67-72, 1975.

3147 ILEOSTOMY IN THE ELDERLY. *(E.)* Abrams, A. V.; Corman, M. L.; Veidenheimer, M. C. (Lahey Clin. Found., Boston, Mass.). *Dis. Colon Rectum* 18(2):115-117, 1975.

3148 BILE ACID KINETICS WHEN THE ENTEROHEPATIC CIRCULATION IS DISRUPTED. *(Ger.)* Begemann, F. (1st Med. Clin., Univ. Hamburg, Germany). *Z. Gastroenterol.* 12(2):125-130, 1974.

3149 COMPENSATORY HYPERTROPHY OF THE ILEUM AFTER GASTRODUODENOJEJUNAL EXCLUSION. *(E.)* Tilson, M. D.; Sweeney, T.; Wright, H. K. (Yale Univ. Sch. Med., New Haven, Conn.). *Arch. Surg.* 110(3):309-312, 1975.

3150 GASTRO-INTESTINAL HORMONAL RESPONSES FOLLOWING MASSIVE SMALL BOWEL RESECTION. *(E.)* Barros D'sa, A. A. B.; Kennedy, T. L.; Buchanan, K. D.; Parks, T. G. (Dep. Surg. Med., Queen's Univ., Belfast, Northern Ireland). *Br. J. Surg.* 62(2):152, 1975.

3151 SUBTOTAL RESECTION OF THE SMALL INTESTINE IN NEWBORNS. THE USE OF A NEW, COMPLETELY SYNTHETIC, BASIC DIET. *(Ger.)* Heine, W.; Richter, I.; Muller, T. (Dep. Med., Univ. Rostock, Germany). *Zentralbl. Chir.* 99(34):1076-1080, 1974.

3152 TREATMENT OF RESECTIONS OF THE SMALL INTESTINE BEYOND THE IMMEDIATE POSTOPERATIVE PERIOD. *(Fr.)* Gendre, J. P.; Le Quintrec, Y. (Albert Chenevier Hosp., Creteil, France). *Ann. Anesthesiol. Fr.* 15(Suppl. 1):109-117, 1974.

3153 THE CONSEQUENCES OF INTESTINAL RESECTIONS AS A FUNCTION OF THEIR TOPOGRAPHY AND EXTENT. *(Fr.)* Le Quintrec, Y.; Gendre, J. P. (Albert Chenevier Hosp., Creteil, France). *Ann. Anesthesiol. Fr.* 15(Suppl. 1):75-79, 1974.

3154 PROTEIN-LOSING ENTEROPATHY IN LYMPHOMA OF THE SMALL INTESTINE. *(E.)* Padilla, F.; Hall, W. H.; Boyd, C. M.; Thompson, B. W. (Univ. Arkansas Med. Cent., Little Rock). *South. Med. J.* 68(3):354-357, 1975.

3155 SUBMUCOSAL JEJUNAL ANEURYSM. *(E.)* Lesna, M.; Tweedle, D. E. F. (Dep. Pathol., Univ. Newcastle upon Tyne, England). *Beitr. Pathol.* 154(2): 190-195, 1975.

3156 FATAL PARALYTIC ILEUS COMPLICATING PHENOTHIAZINE THERAPY. *(E.)* Giordano, J.; Huang, A.; Canter, J. W. (George Washington Univ. Med. Cent., Washington, D.C.). *South. Med. J.* 68(3):351-353, 1975.

3157 INTESTINAL LYMPHANGIECTASIS, REPORT ON SIX CASES. *(E.)* Bennet, J.; Cronier, J.; Fortier-Beaulieu, M.; Labrune, M.; Prot, D. (Herold Hosp., Paris, France). *Ann. Radiol. (Paris)* 17(4): 345-354, 1974.

3158 PAPILLARY LYMPHOID HYPERPLASIA OF THE TERMINAL ILEUM: AN UNUSUAL CAUSE OF INTUSSUSCEPTION AND GASTROINTESTINAL BLEEDING IN CHILDHOOD. *(E.)* Schenken, J. R.; Kruger, R. L.; Schultz, L. (Univ. Nebraska Med. Cent., Omaha). *J. Pediatr. Surg.* 10(2):259-266, 1975.

3159 VALUE OF THE TILT UPSIDE-DOWN MANEUVER FOR ROENTGEN EXAMINATION OF PELVIC SMALL-BOWEL LOOPS. *(E.)* Dodds, W. J.; Lydon, S. B.; Stewart, E. T.; Binder, G. A. (Med. Coll. Wisconsin, Milwaukee). *Am. J. Roentgenol. Radium Ther. Nucl. Med.* 123(2):412-414, 1975.

3160 ACUTE VASCULAR COMPRESSION OF THE DUODENUM FOLLOWING CAST APPLICATION. *(E.)* Bisla, R. S.; Louis, H. J. (Phoenix Orthop. Resid. Programme, Ariz.). *Surg. Gynecol. Obstet.* 140(4):563-566, 1975.

3161 HYPERPLASIA OF BRUNNER'S GLANDS. *(E.)* Maratka, Z.; Kocianova, J.; Kudrmann, J.; Jirko, P.; Pirk, F. (Hosp. Bulovka, Prague, Czechoslovakia). *Acta Hepatogastroenterol. (Stuttg.)* 22(1):61-62, 1975.

3162 RUPTURE INTO THE DUODENUM OF A MYCOTIC ANEURYSM OF THE COMMON ILIAC ARTERY. REPORT OF A CASE. *(E.)* Olesen, F.; Larsen, N. K.; Bone, J. (Esbjerg Cent. Hosp., Denmark). *Acta Chir. Scand.* 141(1):76-78, 1975.

3163 GALLSTONE ILEUS. Serfas, L. S.; Jandali, A. M. (Easton Hosp., Pa.). *Pa. Med.* 78(4): 50-60, 1975.

3164 THE RADIOLOGIC DIAGNOSIS OF SPONTANEOUS MESENTERIC VENOUS THROMBOSIS. *(E.)* Clemett, A. R.; Chang, J. (New York Univ. Sch. Med., N.Y.). *Am. J. Gastroenterol.* 63(3):209-215, 1975.

3165 PRE- AND POSTOPERATIVE CARE OF THE PATIENT WITH INTESTINAL BYPASS FOR OBESITY. *(E.)* Swenson, Jr., S. A.; Oberst, B. (Univ. Nebraska Med. Cent., Omaha). *Am. J. Surg.* 129(3):225-228, 1975.

3166 MIDGUT NONROTATION IN ADULTS. AN AGGRESSIVE APPROACH. *(E.)* Gohl, M. L.; DeMeester, T. R. (Tripler Army Med. Cent., Honolulu, Hawaii). *Am. J. Surg.* 129(3):319-323, 1975.

3167 PATHOLOGY AND CLINICAL ASPECTS OF HEMANGIOMAS OF THE SMALL INTESTINE: A RARE CAUSE OF GASTROINTESTINAL BLEEDING. (FOUR CASES). *(It.)* Bettini, U.; Cardona, G. (Emerg. Surg., Univ. Florence, Italy). *Arch. De Vecchi Anat. Patol.* 58(1/2/3): 525-556, 1973.

3168 PHARMACOLOGICAL PREVENTION AND TREATMENT OF POST-TRAUMATIC ILEUS. *(Fr.)* d'Athis, F. (no affil.). *Ann. Anesth. Fr.* 15(Suppl. 1):117-122, 1974.

3169 MASSIVE ENTERECTOMIES: PATHOPHYSIOLOGICAL CONSEQUENCES AND ADAPTATION MECHANISMS. *(Fr.)* Dauchel, J.; Schang, J. C.; Sava, G.; Jaeck, D.; Grenier, J. F. (no affil.). *Rev. Fr. Gastroenterol.* (103):47-50, 53-54, 56, 1974.

3170 DUODENAL DIVERTICULA AND BILIARY DISEASE: VALUE OF A COMPLETE RADIOLOGICAL EXAMINATION. *(Fr.)* Delahaye, R. P.; Rignault, D.; Laverdant, C.; Metges, P. J.; Chantome, M. (Begin Hosp., Saint-Mande, France). *Rev. Fr. Gastroenterol.* (102): 7-8, 11-14, 16-18, 22, 1974.

3171 INTRADUODENAL DIVERTICULUM: A CASE REPORT. *(Ger.)* Stolze, T.; Berger, H.; Preiss, H.; Sykosch, H. J. (2nd Med. Clin., Univ. Dusseldorf, Germany). *Fortschr. Geb. Roentgenstr. Nuklearmed.* 121(2):250-251, 1974.

3172 SPONTANEOUS DUODENOCOLIC FISTULA. *(E.)* McKelvey, S. T. D.; Carr, D.; Lesna, M.; Johnston, I. D. A. (R. Victoria Infirm., Newcastle, Scotland). *J. R. Coll. Surg. Edinb.* 20(1):54-57, 1975.

3173 A CASE OF LEIOMYOSARCOMA OF THE PROXIMAL SMALL INTESTINE AND THE ONSET OF JEJUNAL INTUSSUSCEPTION. *(Ger.)* Simeonov, S.; Kaltscheva, V. (I. P. Pavlov Med. Fac., Plovdiv, Bulgaria). *Fortschr. Geb. Roentgenstr. Nuklearmed.* 121(2):254-256, 1974.

3174 DIAGNOSIS AND TREATMENT OF DISEASES OF VISCERAL GASTROINTESTINAL ARTERIES. *(Fr.)* van de Berg, L.; Lombard, R.; Dreze, C. (Dep. Surg., Univ. Liege, Belgium). *Rev. Med. Liege* 29(24):751-763, 1974.

3175 DISTENTION OF THE INTESTINAL LUMEN: POSSIBLE RESULT OF SECRETION DURING INTESTINAL PERFUSION. *(Fr.)* Wingate, D. L.; Phillips, S. F. (London Hosp. Med. Coll., England). *Biol. Gastroenterol. (Paris)* 7(4):310-311, 1974.

See also, 2818, 2881, 2886, 2896, 2897, 2943, 2944, 2959, 2964, 3012, 3050, 3058, 3071, 3083, 3197, 3198, 3199, 3247, 3277, 3282, 3294, 3295, 3371, 3554, 3601, 3615, 3636, 3651, 3658, 3667, 3671, 3672, 3674, 3676, 3677, 3679, 3685, 3719, 3745, 3748, 3760, 3782.

SMALL INTESTINE

Malabsorption

3176 INCIDENCE OF CELIAC DISEASE. *(Fr.)* Bernier, J. J.; Bourdeloux, J. J. (St. Lazare Hosp., Paris, France). *Arch. Fr. Mal. App. Dig.* 63:361-364, 1974.

Celiac disease has been diagnosed in 90 adults and 299 children less than 15 yr old who were born in the Paris area between 1882 and 1972; 32% were males and 68% females. In all of these cases, diagnosis was confirmed by intestinal biopsies and regression of the disease after institution of a gluten-free diet. In the Paris area there is 1 case/75,000 adult inhabitants attending the hospitals in this study. Among children, the incidence was 1 case/5454 children living in Paris and 1 case/4138 children living in the Paris area. A more detailed study of children born in 1970-1972 who developed celiac disease before age 2 yr, showed 1 case/2500 births in the Paris area. Among North Africans, mostly Algerians, living in Paris, the incidence was much higher (1 case/250 children less than 15 yr old). An apparent increase in the incidence of celiac disease in children born between 1960 and 1968 and those born between 1970 and 1972 may be due to a difference in the incidence of symptomatic and asymptomatic forms.

3177 BILE ACID MALABSORPTION IN CHILDREN WITHOUT INTESTINAL RESECTIONS. *(Fr.)* Weber, A.; Roy, C. C.; Chartrand, L.; Morin, C. L.; van Caillie, M. (St. Justine Hosp., Montreal, Canada). *Union Med. Can.* 103(12):2089-2094, 1974.

Fecal lipids and bile acids were measured in 72-hr stool specimens from 87 children with a variety of gastrointestinal disorders and 18 controls. None of the patients had a history of hepatobiliary disease or intestinal resection. Bile acid malabsorption was detected in 1 of 6 children with Crohn's disease, 2 of 8 with refractory diarrhea, 3 of 4 with chronic specific diarrhea (2 with salmonellosis and 2 with giardiasis), all of 4 with bacterial contamination of the upper intestine due to intestinal stasis, and all of 36 patients with cystic fibrosis. No evidence of bile acid malabsorption was found in 16 children with celiac disease or 7 with irritable colon. These findings differ from those reported in the literature on adults with Crohn's disease and irritable colon. Intestinal transit was decreased to a comparable extent in children with irritable colon, celiac disease, and cystic fibrosis, although fecal excretion of bile acids was not increased in irritable colon or celiac disease. Thus, increased fecal bile acid contents cannot be explained by increased transit times in cystic fibrosis.

3178 STENOSIS OF THE SMALL INTESTINE ASSOCIATED WITH STAGNANT LOOP SYNDROME AND MALABSORPTION. *(Fr.)* Hurtubise, M.; Emond, M.; Rousseau, B. (Notre Dame Hosp., Montreal, Canada). *J. Can. Assoc. Radiol.* 25(3):227-233, 1974.

Case reports are presented for 3 patients with stagnant loop syndrome and malabsorption. A 50-yr-old

woman who had undergone 2 ileotransversostomies over a 23-yr period for Crohn's disease developed malabsorption and steatorrhea. X-rays showed distension of the small intestine above the anastomosis. A 15-yr-old boy with a 1-yr history of diarrhea presented with growth retardation, ascites, edema of the lower extremities, and edematous infiltration of the abdominal wall. Laboratory investigations revealed severe malabsorption, steatorrhea, and severe hypoproteinemia. X-rays showed distension of about 100 cm of proximal small intestine which was 10 cm in diameter in the most severely affected part. At laparotomy, a stenotic segment of small intestine, about 35 cm long, was found below the distended segment. On the basis of ulcerations, epithelioid follicles, and occasional polynuclear eosinophils in this stenotic segment, a diagnosis of Crohn's disease was established, but sarcoidosis is also possible due to the presence of Schumann bodies. After removal of stenotic intestine, the patient showed marked improvement: malabsorption disappeared and he gained in weight and stature. A 21-yr old man with a 7-yr history of diarrhea presented with marked growth retardation and malabsorption. Laparotomy showed volvulus of the last loop of the small intestine around an adhesion, with traction being exerted between the cecum and last loop of the small intestine. Adhesions were removed, but the patient's recovery was complicated by a greatly distended loop of small intestine which showed no evidence of mechanical obstruction. The patient gradually improved after this was removed. Three biopsies of this small intestine ruled out the possibility of aganglionosis.

3179 ASSESSMENT OF SMALL BOWEL FUNCTION IN THE ELDERLY USING A MODIFIED XYLOSE TOLERANCE TEST. *(E.)* Webster, S. G. P.; Leeming, J. T. (Chesterton Hosp., Cambridge, England). *Gut* 16(2):109-113, 1975.

Small bowel function was measured in 85 elderly patients (63-95 yr old, mean age 81) irrespective of renal function by determining the ratio between the amount of xylose recovered in the urine after a p.o. dose and the amount recovered after i.v. administration. No patients with small bowel disease or suggestive symptoms were included nor were those with a diagnosed noeplastic lesion or ascites. A younger group ranging in age from 18-35 yr was also studied. Subjects were fasted for at least 8 hr after which they were given 25 g of d-xylose in 200 ml water p.o. or 5 g of xylose in a 10% solution injected slowly i.v. over 2-3 min. Urine was collected for 5 hr after xylose administration, the total volume measured, and analyzed for xylose. In 69 elderly patients without catheters, 5-hr urinary xylose recovery after the p.o. dose ranged from 0.1-7.3 g and after the i.v. dose ranged from 0.4-2.5 g. In 16 elderly patients with catheters, 5-hr urinary xylose recovery after the p.o. dose ranged from 0.7-6.5 g and after the i.v. dose from 0.5-2.4 g. Corresponding values in the 20 young controls were 3.7-9.0 g after the p.o. dose and 1.1-2.7 after i.v. administration. These findings indicate that the absorption of d-xylose from the small bowel is impaired in old age. The ability to absorb xylose was very variable in the aged subjects but 26% of those elderly subjects studied had a xylose test absorption ratio below the calculated normal range of the young subjects. In a previously published report it was concluded that absorption of xylose was not impaired in the elderly. There are two possible explanations for the difference between the earlier results and those reported in this paper: 1) the first group was younger than the group studied in the present report; and 2) no dietary restrictions were imposed on subjects undergoing the i.v. test in the previously reported study. It is concluded that poor renal function, incomplete bladder emptying, and altered gastric emptying are not possible causes for the differences between the two age groups.

3180 COMPUTER CARD MORPHOMETRY OF JEJUNAL BIOPSIES IN CHILDHOOD COELIAC DISEASE. *(E.)* Meinhard, E. A.; Wadbrook, D. G.; Risdon, R. A. (R. Free Hosp., London, England). *J. Clin. Pathol.* 28(2):85-93, 1975.

Histological changes in 95 jejunal biopsy specimens from children have been analyzed by a new morphometric technique. The microscope image of the specimen is traced directly onto computer data cards. A simple sketch records accurate quantitative data in a matrix of 840 points, retaining the spatial arrangement of the tissue components. Data are fed, *via* an optical mark data card reader, into a mini-computer. FORTRAN IV programs allow calculation of surface area, villous heights, and component volumes in metric units, and of volume proportions, volume:volume ratios, and surface:volume ratios. Pictorial and numerical printouts are produced, which are suitable for inclusion in the patient's notes. Jejunal biopsies from 37 controls and 26 untreated celiac patients were clearly distinguished morphometrically. Untreated celiac mucosae were flat; the surface area fell from a control value of 3.13 mm^2/mm^2 muscularis mucosae to 1.13 mm^2/mm^2 muscularis mucosae. The surface epithelial volume fell from 0.16 mm^3/mm^2 (or 34% of total mucosal volume) to 0.03 mm^3/mm^2 muscularis mucosae (or 8% of the total mucosal volume). The cumulative villus height fell similarly from 2942 μ to 50 μ. The crypt volume rose significantly in untreated celiac mucosa from control volume of 0.09 mm^3/mm^2 (21% of total mucosal volume) to 0.17 mm^3/mm^2 muscularis mucosae (39% total mucosal volume). The ratio of surface epithelial volume to crypt volume fell significantly from 1.74 in controls to 0.21 in untreated celiacs. The volumes of surface-related and crypt-related lamina propria show a pattern of changes similar to their respective epithelial components. When on a gluten-free diet, treated celiac children show few differences from controls. A return of dietary gluten causes a reversion of the results towards those of the untreated celiac group. It is noted however, that the total mucosal volume does not differ between the groups, suggesting that the mucosal lesion in celiac disease is not a true atrophy.

3181 IRON DEFICIENCY ANEMIA AND MALABSORPTION. *(Ger.)* Vetrella, M.; De Masi, V.; Tancredi,

F. (Santa Annunziata Hosp., Naples, Italy). *Monatschr. Kinderheilk.* 122(7):562-564, 1974.

Eight patients, aged 12-36 months, with iron-deficiency anemia and symptoms of intestinal malabsorption (diarrhea, pathological xylose-test, pathological test for fecal fat) were treated with parenteral doses of iron along with an otherwise unrestricted diet. A peroral biopsy showed partial to total atrophy of the mucosa in the small intestine of 7 of these 8 patients. Within 4 to 12 days after institution of parenteral treatment with iron, diarrhea ended; hematological parameters normalized within 3 weeks. The fat excretion normalized within 10 days to 4 months and the xylose test, within 1 to 2 months. The peroral biopses were normal 6 months after institution of treatment.

3182 CORRECTION OF THE MALABSORPTION OF THE PRETERM INFANT WITH A MEDIUM-CHAIN TRIGLYCERIDE FORMULA. *(E.)* Roy, C. C.; Ste-Marie, M.; Chartrand, L.; Weber, A.; Bard, H.; Doray, B. (Sainte-Justine Hosp., Montreal, Canada). *J. Pediatr.* 86(3): 446-450, 1975.

The extent of fat malabsorption in preterm infants fed long-chain triglyceride diets and the effects of a medium-chain triglyceride formula on the steatorrhea and resultant caloric deficiency were investigated in 25 preterm infants weighing 1,300-1,800 g. After receiving a milk-based formula for 1 week, 16 infants were fed 2 isocaloric formulas containing either medium-chain or long-chain triglycerides for 15 days. The alternate formula was given for a second period of identical duration. In the second part of the study, 9 infants were given medium-chain triglycerides, and long-chain triglycerides in which the chloride concentration was that of the medium-chain triglyceride diet (21 mEq/liter). Nitrogen was measured in aliquots of formula, urine, and stools by the micro Kjeldahl method. Stool fat was determined by a technique which quantitatively extracted medium- and long-chain fatty acids. The assay of bile acids in feces was performed by a modification of the enzymatic method. Serum base excess, pH, total CO_2, sodium, potassium and chloride were also measured. While receiving the medium-chain triglyceride diet, the infants had greater percent fat absorption, as compared to 83.4% with the long-chain triglycerides (97.1%) and weight gain, 11.5 g/kg/100 calories and 7.5 g/kg/100 calories, resp. It is concluded that this study confirms both the presence of fat malabsorption in premature infants and the beneficial effects of a medium-chain triglyceride diet.

3183 THE EFFECT OF CHOLESTYRAMINE ON INTESTINAL ABSORPTION. *(E.)* West, R. J.; Lloyd, J. K. (Inst. Child Health, London, England). *Gut* 16(2): 93-98, 1975.

The effect of long-term treatment with cholestyramine on the absorption of fat, vitamins, and some minerals was studied in children with familial hypercholesterolemia. Eighteen children were treated with cholestyramine (0.6 g/kg/day) for 1-2 1/2 yr, during which time various biochemical determinations were made. In patients treated for over 1 yr, the mean serum folate concentration decreased from 7.7 ng/ml to 4.4 ng/ml; a corresponding lowering of red cell folate was also observed. Oral folic acid (5 mg/day) overcame the deficiency. Prothrombin time remained normal in all patients. There was a significant decrease in the serum concentrations of vitamins A and E and of inorganic phosphorus over the first 2 yr of treatment, although the values remained within the normal range. Concentrations of serum iron, vitamin B_{12}, plasma calcium, and protein did not change significantly. Five of seven children eating normal diets had fecal fat of over 5 g/day while on cholestyramine; none had diarrhea or weight loss. There was no consistent relationship between dosage and fecal fat. The results of the study show no evidence that cholestyramine impairs absorption of iron or vitamin B_{12}, and the normal growth rate in children and the maintenance of plasma protein concentration provide further evidence of the safety of prolonged administration of cholestyramine.

3184 PTEROLYGLUTAMIC ACID MALABSORPTION IN TROPICAL SPRUE. *(E.)* Corcino, J. J.; Coll, G.; Klipstein, F. A. (Univ. (Dist.) Hosp., San Juan, Puerto Rico). *Blood* 45(4):577-580, 1975.

Pteroylglutamic acid absorption was assessed in 10 untreated tropical sprue (20-62 yr old) and 8 control subjects using a marker perfusion technique. After an overnight fast, the subjects were perfused with an isosmotic solution containing 25 ng/ml of crystalline pteroylglutamic acid with either mannitol or glucose at a concentration of 55.6 mM and a pH of 7.2. Perfusion rate was 9.2 ml/min. Each subject was perfused on 2 consecutive days. Polyethylene glycol was used as a nonabsorbable marker. Pteroylglutamic acid was measured microbiologically using *Streptococcus fecalis*. Absorption of pteroylglutamic acid was 47.3% and 28.1% for the controls and tropical sprue patients, resp., using the mannitol solution. There was considerable overlap between % pteroylglutamic acid absorbed by both groups. When the same subjects were perfused with the glucose solution, pteroylglutamic acid absorption was 58.8% and 9.8% for the controls and tropical sprue patients, resp. A clear-cut separation was observed between both groups with differences in absorption significant to the $p<0.001$ level. These results confirm those of a previous study using marker perfusion techniques and indicate, in a larger number of subjects, that malabsorption of physiologic doses of pteroylglutamic acid is demonstrable in all subjects with tropical sprue when the appropriate techniques are used.

3185 SUBEPITHELIAL COLLAGEN IN INTESTINAL MALABSORPTION. *(E.)* Bossart, R.; Henry, K.; Booth, C. C.; Doe, W. F. (R. Postgrad. Med. Sch., London, England). *Gut* 16(1):18-22, 1975.

Intestinal biopsies from 146 patients with adult celiac disease and 13 patients with intestinal villous atrophy of different etiology (seven with tro-

pical sprue, four with Whipple's disease, one with hypogammaglobulinemia, and one with strongyloidiasis) were assessed for the presence of subepithelial collagen and compared with 20 controls. All sections were stained with hematoxylin and eosin and with hematoxylin van Gieson. A grading system was devised to assess the presence and amount of subepithelial collagen: grade 1, stainable collagen either absent or confined to the vicinity of the basement membrane; grade 2, a definite zone of subepithelial collagen which involved the subepithelial vessels, and which resulted in a thickened linear staining pattern; and grade 3, a thick irregular collagen band which extended into the lamina propria to variable depths. The amount of stainable collagen in biopsies from control subjects never exceeded grade 1. In 94 of 146 patients with adult celiac disease (64%), the biopsies also showed grade 1 staining. Forty-one patients, (28%) however, showed a grade 2 staining pattern and 11 (8%) showed grade 3. Grade 2 staining was seen in the biopsies from two tropical sprue patients and grade 3 in a third. The tendency of the epithelial layer to strip off over collagen bands and the focal nature of the fibrotic process even within a single biopsy were conspicuous histological features. The effect of treatment with a gluten-free diet was studied in follow-up jejunal biopsies of 51 adult celiac patients who had taken the diet for at least 6 months. In most cases the subepithelial changes regressed following treatment but no improvement occurred in three patients whose pre-treatment biopsies showed grade 3 changes despite prolonged gluten withdrawal. Two of these three patients died of unremitting malabsorption. The results of this study confirm that collagenous subepithelial thickening, sometimes extending deeply into the lamina propria of jejunal biopsies, is a common finding of adult celiac disease. Identical changes, however, were seen in biopsies from tropical sprue patients. Subepithelial collagen, therefore, is a non-specific finding probably related to an inflammatory reaction occurring in the region of the basement membrane.

3186 ENDOCRINE CELLS IN THE HUMAN JEJUNAL MUCOSA IN NORMAL SUBJECTS AND PATIENTS WITH CELIAC SPRUE. *(Cz.)* Lojda, Z.; Fric, P. (1st Inst. Pathol. Anat., Charles Univ., Prague, Czechoslovakia). *Cesk. Gastroenterol. Vyz.* 28(1):1-10, 1974.

Peroral biopsies of the jejunal mucosa, obtained from 15 patients with celiac disease and 12 normal subjects, were examined under the electron microscope and with a variety of histochemical tests. On the basis of the size and shape of the granules they contained, endocrine cells were classified into four groups. Enterochromaffin (EC) cells, which constituted more than half of the endocrine cells, had very dense, polymorphic granules measuring 200-600 nm. L-cells were the second most common type; their granules were large (200-400 nm) and round and were somewhat less dense than granules in EC-cells. S-cells were not found as often and contained small (100-250 nm) round granules; in some cases, it was impossible to differentiate S-cells from L-cells. D-cells were present in small numbers in only three biopsies and contained round granules, measuring 300-400 nm, of low density which resembled granules in the D-cells in the islands of Langerhans. All four types of endocrine cells were found in contact with the intestinal lumen. The free surface of these cells were always equipped with microvilli which were smaller than those of the enterocytes and a poorly developed glycocalyx. The presence of pinocytotic vacuoles below the microvilli indicates that the surface from which microvilli project is involved in the absorption of material from the intestinal lumen. EC-cells could be differentiated from other endocrine cells by histochemical methods on material fixed with formol or glutaraldehyde, while L-, S-, and D-cells could be detected on frozen sections of unfixed tissue. Biopsies from six patients with celiac disease contained larger than normal numbers of both EC- and L-cells. Endocrine cells more often bordered the lumen than in biopsies from normal subjects. Vacuoles, the size of which corresponded to those of specific granules, were present in larger than normal numbers, particularly in L-cells. This finding is interpreted as an increase in the release of the contents of these granules. Emiocytosis was not observed in any type of endocrine cell, either in normal subjects or in patients with celiac disease.

3187 ENZYME ACTIVITIES AND PROPERTIES OF LYSOSOMES AND BRUSH BORDERS IN JEJUNAL BIOPSIES FROM CONTROL SUBJECTS AND PATIENTS WITH COELIAC DISEASE. *(E.)* Peters, T. J.; Heath, J. R.; Wansbrough-Jones, M. H.; Doe, W. F. (R. Postgrad. Med. Sch., London, England). *Clin. Sci. Mol. Med.* 48(4): 259-267, 1975.

The properties and enzymic activities of lysosomes in normal human intestinal mucosa and in mucosa from patients with untreated and treated (by dietary gluten withdrawal) celiac disease were studied. All 4 brush border enzymes (leucyl β-naphthylamidase, alkaline phosphatase, β-galactosidase, and α-glucosidase) were significantly depressed in the jejunal biopsy specimens from the untreated celiac disease patients; the decrease was particularly striking for brush-border β-galactosidase. In the treated celiac group, the enzyme activities returned toward normal values, paralleling morphological and functional improvement. The mean activities of *N*-acetyl-β-glucosaminidase, β-galactosidase, acid phosphatase, acid diesterase, acid-β-galactosidase, and β-glucuronidase were significantly increased in the untreated celiac patients, the activities decreasing toward normal values in the treated patients. The cytosol enzyme lactate dehydrogenase showed a significant decrease in the untreated celiac mucosa with a return to normal activity after treatment. Measurement of brush-border integrity by differential centrifugation of biopsy extracts indicated increased fragility of the brush borders in the untreated patients; the treated patients showed normal values. Assessment of lysomal integrity by assay of latent *N*-acetyl-β-glucosaminidase and the sedimentable activity of 4 acid hydrolases demonstrated increased lysosomal fragility in the

untreated celiac mucosa and normal values in the biopsies from the treated patients. The results indicate that the microvilli of celiac enterocytes are more fragile than normal, that the lysosomes play a role in the pathogenesis of the enterocyte damage in celiac disease, and that the pathogenesis of the disease is related to a toxic effect of gluten or an immunological mechanism.

3188 EFFECT OF PANCREATIN ON VITAMIN B_{12} MALABSORPTION IN PATIENTS WITH TOTAL PANCREATECTOMY. *(E.)* Morishita, R.; Fujii, M.; Yamamoto, T.; Wakisaka, G.; Matsumoto, Y.; Ono, H. (Kyoto Univ. Sch. Med., Japan). *Digestion* 11(3/4):240-248, 1974.

The effect of pancreatin on vitamin B_{12} absorption was studied in 3 patients who had undergone total pancreatectomy for cancer, 3 patients who had undergone partial pancreatectomy (1 in which the stomach was totally extirpated), and 1 patient with pernicious anemia. B_{12} absorption was measured using a whole body spectrometer before, 35 min after, and 7 days after the oral administration of 0.2-0.3 µg ^{60}Co-B_{12} (specific activity 0.73-0.8 or 2-3 µCi/µg). Marked B_{12} malabsorption was observed in all patients who had undergone total pancreatectomy, the patient who had undergone total gastrectomy and partial pancreatectomy, and the patient with pernicious anemia. B_{12} absorption was normal or somewhat depressed in the other 2 cases of partial pancreatectomy. In 2 cases of total pancreatectomy, administration of 12 g pancreatin markedly improved B_{12} absorption. In the third case, pancreatin in conjunction with normal human gastric juice brought about a marked improvement in B_{12} retention; the gastric juice in this patient revealed achlorhydria. Pancreatin did not enhance B_{12} absorption in the partial gastrectomy or pernicious anemia patients. The beneficial effect of pancreatin on B_{12} absorption in the total pancreatectomy cases was reduced by heating at 100 C for 10 min. B_{12} retention in the 2 cases of partial pancreatectomy was decreased by pancreatin administration. Fat absorption was improved by the administration of small amounts of pancreatic enzymes in 2 cases of total pancreatectomy, 1 of which had not shown improved B_{12} absorption after pancreatin alone. Exocrine secretions of the pancreas were severely inpaired in the patients with pancreatic disorders. The results do not clarify the mechanism by which pancreatic extract improves B_{12} absorption in patients with exocrine pancreatic insufficiency.

3189 THE ROENTGENOGRAPHIC AND CLINICAL FINDINGS IN WHIPPLE'S DISEASE: A REVIEW OF 8 PATIENTS. *(E.)* Philips, R. L., Carlson, H. C. (Mayo Clin., Rochester, Minn.). *Am. J. Roentgenol. Radium Ther. Nucl. Med.* 123(2):268-273, 1975.

The clinical and roentgenographic findings in 8 patients (6 men and 2 women; average age at diagnosis 53 yr) with Whipple's disease are reported. Seven patients had abnormal roentgenograms with coarse folds and slight dilatation of the small bowel. Measurement of the mucosal folds and jejunal and duodenal width indicated thickening. The eighth patient showed no roentgenographic abnormalities. All patients had watery diarrhea and had undergone weight loss, and arthralgia was present in 7 cases. There were few physical signs, but lymphadenopathy, pigmentation, perifollicular purpura, and/or edema were present in some patients. All patients had decreased levels of serum albumin and 7 had excessive losses of fat in the stool. Periodic acid-Schiff positive macrophages in the cytoplams of the jejunal mucosa were invariably present on biopsy. All patients were treated with tetracycline (250 mg 4 times/day), which resulted in slow but steady improvement. All repeat roentgenograms and biopsy specimens showed evidence of improvement in the small bowel. The roentgenographic findings in Whipple's disease are nonspecific and resemble those of other causes of malabsorption. Positive identification of the disease is probably not possible roentgenographically, small bowel biopsy being necessary to confirm its presence.

3190 A FAMILY STUDY OF COELIAC DISEASE. *(E.)* David, T. J.; Ajdukiewicz, A. B. (Bristol Gen. Hosp., England). *J. Med. Genet.* 12(1):79-82, 1975.

The genetic mechanisms involved in the hereditary transmission of celiac disease were investigated in a family study of 141 cases on biopsy proven celiac disease in southwestern England. Thirteen patients (9%) had a positive family history of celiac disease involving a total of 21 affected relatives. Of the 13 cases with a positive family history, 4 were children. In 5 families, only a parent and child were affected, and vertical transmission through 3 generations was seen in a 6th family. In 5 additional families, only 2 sibs were affected; 4 of the sib pairs were of the same sex and there was one concordant set of monozygotic female twins. Of the 141 cases originally studied, 95 were female; the preponderance of females was absent among the childhood cases, but 99% of the adults were female. The pattern of inheritance in the 13 families with repeated celiac disease is compatible with an autosomal dominant gene with incomplete penetrance. However, other possibilities are not ruled out; a common recessive gene requiring an environmental factor for the disease to appear in homozygotes; polygenic or multifactorial inheritance; or multiple causation with forms inherited in various ways.

3191 MALABSORPTION SYNDROME ASSOCIATED WITH HUMORAL IMMUNE DEFICIENCIES. *(Ger.)* Bolte, J. P.; Hopf, U.; Knolle, J.; Olbermann, M.; Meyer zum Buschenfelde, K. H. (2nd Med. Clin., Univ. Mainz, Germany). *Z. Gastroenterol.* 12(Suppl.):430-431, 1974.

3192 NIGHT BLINDNESS IN THE BLIND LOOP SYNDROME FOLLOWING GASTROJEJUNOSTOMY. *(E.)* Levy, N. S.; Toskes, P. P. (VA Hosp., Gainesville, Fla.). *J. Abdom. Surg.* 17(1):20-25, 1975.

3193 THE IMPLICATIONS OF LACTOSE INTOLERANCE IN CHILDREN. *(E.)* Jones, D. V.; Latham, M. C. (Dep. Nutr., Cornell Univ., Ithaca, N.Y.). *Environ. Child Health* 20(5):261-271, 1974.

3194 FAT MALABSORPTION ASSOCIATED WITH BACTERIAL COLONIZATION OF A COLON TRANSPLANT: A CASE REPORT. *(E.)* Mallinson, C. N.; Drasar, B. S.; Trounce, J. R. (Greenwich Hosp., London, England). *Guys Hosp. Rep.* 122(3/4):231-244, 1973.

3195 INTESTINAL ABSORPTION AND IRON DEFICIENCY. *(Sp.)* Garcia Cobo, M. C.; De Castro del Pozo, S.; Fernandez-Renedo, A.; Herreros Fernandez, V. (Fac. Med., Valladolid, Spain). *Sangre* 19(1): 22-29, 1974.

3196 POSTTRAUMATIC GASTROINTESTINAL MALABSORPTION. *(Fr.)* Richard, A. (Henri Mondor Hosp., Creteil, France). *Ann. Anesthesiol. Fr.* 15 (Suppl. 1):18-22, 1974.

3197 SURVIVAL IN GOOD HEALTH FOR 21 YEARS AFTER REMOVAL OF ALL BUT EIGHTEEN INCHES OF THE SMALL INTESTINE. *(E.)* Mallinson, C. N.; Merivale, W. H. H. (Greenwich Hosp., London, England). *Guys Hosp. Rep.* 122(384):269-298, 1973.

3198 MEGALOBLASTIC ANEMIA FOLLOWING ESOPHAGOJEJUNOSTOMY AND TOTAL GASTRECTOMY. *(Ser.)* Stefanovic, S.; Papo, I.; Protic-Hlushichka, D.; Antic, M.; Kalanovic-Kangrga, R.; Rodic, S.; Veljovic, R.; Shobic, P.; Cholovic, M. (Med. Fac., Univ. Belgrade, Yugoslavia). *Srp. Arh. Celokup. Lek.* 102(1):1-7, 1974.

3199 MASTOCYTOSIS IN THE INTESTINAL TRACT. *(Ger.)* Bartelheimer, W; Lux, G; Ottenjann, R; Elster, K. (Neuperlach Munic. Hosp., Munich, Germany). *Z. Gastorenterol.* 12(8):608-609, 1974.

3200 MALABSORPTION: PATHOGENESIS AND PATHOLOGICAL ANATOMY. *(Ger.)* Becker, V. (Pathol. Inst., Univ. Erlangen-Nuremberg, Erlangen, Germany). *Z. Gastroenterol.* 13(Suppl.): 189-209, 1975.

3201 IMPAIRED ABSORPTION AND LOSS OF BILE ACID FOLLOWING SURGERY ON THE SMALL INTESTINE IN CHILDREN. *(Ger.)* Holschneider, A. M.; Harms, K.; Boehne, A.; Bidlingmaier, F.; Dewald, M. B. (Pediatr. Clin., Univ. Munich, Germany). *Bruns Beitr. Klin. Chir.* 221(7):516-524, 1974.

3202 LACTOSE TOLERANCE IN MEXICAN AMERICAN CHILDREN. *(E.)* Woteki, C. E.; Weser, E.; Young, E. A. (Univ. Texas Health Sci. Cent., San Antonio). *Am. J. Clin. Nutr.* 28(4):433, 1975.

3203 STUDY OF PALMITATE INCORPORATION INTO THE HUMAN INTESTINAL MUCOSA. *(Fr.)* Sueur, R.; Cerf, M.; di Costanzo, G.; Debray, C. (Dent. Fac., Montrouge, France). *Biol. Gastroenterol. (Paris)* 7 (4):305, 1974.

3204 SMALL INTESTINAL MUCOSA IN COW'S MILK ALLERGY. *(E.)* Kilby, A.; Walker-Smith, J. A.; Wood, C. B. S. (Queen Elizabeth Hosp. Child., London, England). *Lancet* 1(7905):531, 1975.

3205 STUDIES OF CALCIUM METABOLISM IN LACTASE DEFICIENCY IN MAN. *(E.)* Spencer, H,; Kramer, L.; Norris, C. (VA Hosp., Hines, Ill.). *Am. J. Clin. Nutr.* 28(4):431, 1975.

3206 THE INCIDENCE AND APPEARANCE OF METABOLIC BONE DISEASE IN NON TROPICAL SPRUE. *(E.)* French, A. B.; Garn, S. M.; Poznanski, A. K. (Dep. Intern. Med., Univ. Michigan, Ann Arbor). *Am. J. Clin. Nutr.* 28(4):424, 1975.

3207 JEJUNAL HYDROLYSIS AND UPTAKE OF CONJUGATED FOLATE IN TROPICAL SPRUE. *(E.)* Halsted, C. H.; Reisenauer, A. M.; Corcino, J. J.(Dep. Med., Univ. California, Davis). *Am. J. Clin. Nutr.* 28(4): 418, 1975.

3208 SYMPTOM RESPONSE TO LACTOSE REDUCED MILK IN LACTOSE INTOLERANT ADULTS. *(E.)* Jones, D. V.; Latham, M. C.; Kosikowski, F. V.; Woodward, G. (Div. Nutr. Sci., Cornell Univ., Ithaca, N.Y.). *Fed. Proc.* 34(3):930, 1975.

3209 ABSENCE OF THE SUCROSE-ISOMALTASE COMPLEX IN SUCROSE TOLERANCE. *(Fr.)* Schmitz, J. (Hosp. Sick Child., Paris, France). *Biol. Gastroenterol. (Paris)* 7(4):313, 1974.

3210 DISACCHARIDE MALABSORPTION IN THE ESKIMOS IN GREENLAND: RESULTS FROM CLINICAL, ENZYMATIC, AND ABSORPTION STUDIES. *(Ger.)* Gudmand-Hoyer, E. (Gentofte Hosp., Hellerup, Denmark). *Z. Gastroenterol.* 13(Suppl.):244-250, 1975.

See also, 2439, 2818, 2819, 2864, 2898, 3055, 3157, 3169, 3258, 3303, 3660, 3666, 3740.

3211 AN INVESTIGATION INTO THE ENZYME HISTOCHEMISTRY OF ADENOCARCINOMAS OF HUMAN LARGE INTESTINE AND OF THE TRANSITIONAL EPITHELIUM IMMEDIATELY ADJACENT TO THEM. *(E.)* Marsden, J. R.; Dawson, I. M. P. (Dep. Pathol., Univ. Nottingham, England). *Gut* 15(10):783-787, 1974.

The enzyme histochemical patterns of normal colon, colonic adenocarcinoma, and the mucosa immediately adjacent to a carcinoma were studied to determine enzymatic changes in the adjacent epithelium, which might differ from those in the carcinoma and the more distant normal mucosa. Samples of the tissues were prepared for microscopic examination and stained using specific enzyme techniques; the enzymes were quantitated visually according to their depth of staining. Monoamine oxidase activity was moderate in normal mucosa, high in transitional mucosa, and low in carcinoma. Succinate dehydrogenase activity was high in transitional mucosa and low or moderate in normal and carcinomatous mucosa. Glucose-6-phosphate dehydrogenase activity showed a gradation from low in normal mucosa to high in carcinoma, while acid phosphatase showed the reverse of that pattern. The tetrazolium reductase activity was low or moderate in normal and transitional mucosa and high in carcinoma. Based on these findings, a combination of enzyme techniques and techniques for mucosubstances are suggested for detecting malignant transformation in benign lesions, or in detecting precancerous change in histologically normal mucosa in a vulnerable population.

3212 OPPORTUNISTIC INFECTIONS IN COLON CARCINOMA. *(E.)* Keusch, G. T. (Mt. Sinai Sch. Med., City Univ. New York, N.Y.). *Am. J. Clin. Nutr.* 27(12):1481-1485, 1974.

The problem of infections occurring in the patient with colonic carcinoma are reviewed. For many reasons the patient with large bowel cancer becomes a compromised host. The classical symptoms of the disease result from invasive, fungating tumors or annular constricting lesions which often result in ulcerations of the intestinal mucosa, thus providing a direct route of access for invasion by intestinal microflora. The tendency for colonic neoplasms to remain undiagnosed for long periods of time also allows considerable growth and frequent metastases to lymph nodes and liver may result in severe anorexia and cachexia. Chemotherapy may add to the appetite depression of the tumor itself and decrease the adequacy of nutritional intake of the host. Protein malnutrition, from which profound immunological abnormalities result, may be observed. Severe toxicity may result from the concomitant use of 5-fluorouracil and high voltage radiotherapy. For these and other reasons the colonic cancer patient is compromised toward opportunistic infections. Nevertheless, these patients are not unduly susceptible to protozoan and fungal agents. They may become infected with members of the normal bacterial flora of the gut which are provided with a site for penetration of the colonic mucosal barrier by the invasive or necrotizing tumor. *Bacterioides sepsis*, *Clostridium septicum* and other clostridial infections (in the absence of deep traumatic lesions), and left perinephric abscess caused by coliforms and fecal streptococci appear to be characteristic associations with colonic neoplasia. It is stressed that subcutaneous abscess of the left perinephric abscess due to bowel flora must always be investigated to determine the portal of entry. Colonic carcinoma will be present in a significant number of cases. In the absence of a known colonic lesion, diagnostic workup should be performed in all such patients. In fact, a presumptive diagnosis of a splenic flexure lesion can be made in patients with a left perinephric abscess due to coliform bacilli. Barium enema is indicated in older patients with bacterial endocarditis in whom the portal of entry of the organism was not known.

3213 DIET AS AN ETIOLOGICAL FACTOR IN THE DEVELOPMENT OF CANCERS OF THE COLON AND RECTUM. *(E.)* Howell, M. A. (Natl. Cancer Inst., Bethesda, Md.). *J. Chronic Dis.* 28(2):67-80, 1975.

Food consumption studies, both national and international, were compared to a Japanese case control study to investigate relationships between meat consumption and bowel cancer. The Japanese study used bowel cancer patients and hospital controls matched on age, race, and sex. Total meat use differentiated cases from controls. Beef had the highest relative risk, while chicken and some sources of pork had insignificant relative risk. For the international food consumption data from 37 countries, food figures for beef and veal, total meat, and all food were correlated with mortality and incidence rates. In the U.S. food consumption data, 900,000 people filled out questionnaires on how many times per week they ate 16 different food types. Findings from the international data showed vegetable food sources to be independent or negatively related to intestinal or colonic cancer. All food sources other than vegetables showed high positive relationships. Highest correlations were from per capita consumption of total meat and fat from all food sources. Factor analysis showed that foods associated with the highest mortality rates for colon, breast, and prostate were sugars, meats, eggs, milk and fats. In the U.S. study, no diet items were found to be associated with bowel cancer. In a 1948 study by the Dep. of Agriculture, however, food consumption differences were found for geographical areas and races, which contrasted in bowel cancer mortality or incidence rates. The 1947 incidence rates were 24.6/100,000 in San Francisco, and 17.6/100,000 in Birmingham, while these 2 cities were highest and lowest resp. in consumption of beef, veal and lamb. Results suggest that meat, particularly beef, is associated with malignancy of the large bowel.

3214 CARCINOEMBRYONIC ANTIGEN AND PROGNOSIS IN PATIENTS WITH COLON CANCER. *(E.)* Gerfo, P. L.; Herter, F. P. (Coll. Physicians Surg., Columbia Univ., New York, N.Y.). *Ann. Surg.* 181(1): 81-84, 1975.

Carcinoembryonic antigen serum levels were compared

before and after surgery for carcinoma of the colon. One hundred fifty patients with non-metastatic carcinoma were followed for 24-36 months after colonic resection. Antigen levels greater than 4.0 ng were considered to be elevated. Patients were divided according to Duke's classification of tumor invasiveness into stages A, B and C in increasing severity. High preoperative antigen levels were found in 4 of 25 stage A patients, 25 of 61 stage B, and 39 of 64 stage C. Of the patients who died or survived uncured, 57% had high levels, while only 32% of those successfully cured had high levels. Three of 5 in stage A who died or were uncured had high levels, while 53% of those in stage B, and 70% of those in stage C, who died or were uncured had high levels. In contrast, of those who were cured, only 1 in stage A, 36% in stage B, and 40% in stage C had high levels. It is concluded that high carcinoembryonic antigen levels are correlated with the extent of the disease, and high preoperative levels are associated with poor prognosis.

3215 SPIRAL-SHAPED ORGANISMS ON THE SURFACE COLONIC EPITHELIUM OF THE MONKEY AND MAN. *(E.)* Takeuchi, A.; Jervis, H. R.; Nakazawa, H.; Robinson, D. M. (Walter Reed Army Inst. Res., Washington, D.C.). *Am. J. Clin. Nutr.* 27(11):1287-1296, 1974.

Intestinal spirochetosis was studied in 221 healthy Rhesus monkeys and in specimens from 598 patients by histology, histochemistry, transmission and scanning electron microscopy. Of the 221 monkeys, 31 (14.0%) were massively infected by spiral organisms in the colon, 19 (8.5%) were infected in both colon and rectum and 12 (5.5%) were diffusely infected from cecum to rectum throughout, for an overall incidence of 28%. There were 210 colonic specimens from human subjects, of which 4 were affected by intestinal spirochetosis, 2 of which were associated with adenomatous polyp and the remaining 2 represented normal colonic mucosa. Of the 388 appendices from human subjects, 8 cases (2.1%) showed intestinal spirochetosis. Only 1 specimen showed mild acute appendicitis; the remaining 7 were normal. There were no significant gastrointestinal symptoms with the exception of 2 cases, 1 had a related history of epigastric discomfort and dyspepsia and the second had fever and right lower quadrant pain, symptoms which appear attributable to cholelithiasis and acute appendicitis, resp. The morphologic and ultrastructural findings of this study indicate that the characteristics of intestinal spirochetosis in the rhesus monkey and man are essentially identical in both species. Spiral organisms stained with hemotoxylin and eosin appear as broad basophilic haze on the colonic surface and are strongly positive by Warthin-Starry (silver) stain. Spiral-shaped organisms included 2 structurally different organisms, spirochetes and flagellated microbes. They intimately populated the brush border region of the surface of the colonic epithelium. They were absent in the crypt and small intestine. Infestation produced no alterations of cytocomponents of the underlying host structures. From the observations of this study it is evident that under certain conditions of local microenvironment, spiral microbes may invade the gut mucosa. It is suggested that, when such mucosal penetration occurs in large numbers, it can cause structural alteration and clinical symptoms in the host.

3216 ERRORS IN THE DIAGNOSIS OF CANCER OF THE COLON IN YOUNG PEOPLE. *(Rus.)* Parakhoniak, V. I. (Gorki Med Inst., USSR). *Khirurgiia (Mosk.)* (1):107-111, 1974.

Retrospective studies of 340 patients treated between 1950 and 1971 for cancer of the colon showed that 64 (33 males, and 31 females) were 20-40 yr of age (one patient was 5 yr old). The study revealed a high incidence of diagnostic errors. Only 19 of the 64 patients (30%) were diagnosed properly. Radical surgery could be performed only on 39 patients (61%). Histological examination showed that 33 patients had adenocarcinomas; four mucous cancer; and two solid cancer. The 5-yr survival was recorded in 17 patients, which accounted for 48.6% of radical operations. A case is reported of a 34-yr-old man treated for over 1 yr for chronic hyperplastic gastritis and intercostal neuralgia. The patient was hospitalized with acute abdonimal pain and high fever. The case was successively diagnosed as dysentery, pancreatitis, perigastritis, hyperplastic gastritis and staphylococcosis of the bile ducts. Endoscopic examination finally revealed an intestinal stenosis at the splenic flexure. The surgery found a 15 cm x 15 cm tumor which penetrated into the diaphragm, thoracic wall, retroperitoneal space, the greater curvature of the stomach and the pancreas. Metastases were observed. The patient was pronounced inoperable. It is suggested that a clinical feature of cancer of the colon in young people is vague symptoms in the early stage of the disease.

3217 THE EFFECT OF WHEAT BRAN ON INTESTINAL TRANSIT. *(E.)* Payler, D. K.; Pomare, E. W.; Heaton, K. W.; Harvey, R. F. (Malvern Coll., Worcs, England). *Gut* 16(3):209-213, 1975.

A controlled study was carried out on the effect of bran upon intestinal transit to exclude possible psychological effects. Transit time was determined in 20 healthy volunteers before and after the addition of bran to their diet; transit time was taken as the time required to pass 20 of 25 radiopaque pellets. After the addition of approximately 20 g bran/day to the diet, transit time fell from 2.75 to 2.0 days. Transit became faster in nine subjects who had an initial time 3 days or more, and in 3 of 7 with an initial time of 2 days, but became slower in four with an initial transit of 1 day. Frequency of defecation was not related to transit time and did not increase significantly with bran. In 10 additional volunteers with initial transit of 3-4 days, the effect of bran was compared with than of an equal volume of ground oatflakes. Bran caused a

significant acceleration of transit, whereas oatmeal had no effect. The results confirm that wheat bran accelerates intestinal transit when transit is initially 3 days or longer, and the effect is likely due to the high content of cellulose and hemicelluloses in the bran; it may also slow down fast transit.

3218 THE SURGEON, THE SURGERY, THE PATIENT, AND THE DISEASE: FACTORS COMPLICATING COLONIC SURGERY. *(E.)* Crystal, R. F.; Chang, P. (St. Barnabas Med. Cent., Livingston, N.J.). *Ann. Surg.* 181(1):9-14, 1975.

3219 COMPLICATIONS OF FIBERSIGMOIDOSCOPY. *(Ger.)* Neiger, A. (no affil.). *Z. Gastroenterol.* 12(1):47, 1974.

3220 MODERN CONCEPTS ON NUTRITION IN COLON DISEASES. *(Pol.)* Hasik, J.; Hryniewiecki, L.; Tycowa, M. (Acad. Med., Poznan, Poland). *Przegl. Lek.* 31(3):400-405, 1974.

3221 VOLVULUS OF THE SIGMOID COLON. *(E.)* McDonald, C. C.; Boggs, Jr., H. W. (Confed. Mem. Med. Cent., Shreveport, La.). *South. Med. J.* 68(1):55-58, 1975.

3222 A RARE VARIANT OF AN INTESTINAL AND MESENTERY ANOMALY. *(Rus.)* Kozyr, N. N.; Synovets, A. S.; Ilin, I. I. (N. I. Pirogov Med. Inst., Odessa, USSR). *Klin. Khir.* (8):54-58, 1974.

3223 THE SIGNIFICANCE OF THE INTERNAL ANAL SPHINCTER FOR CONTINENCE AND SUPER-CONTINENCE. STUDIES OF THE ORGAN OF CONTINENCE WITH SPECIAL REGARD TO MEGACOLON. *(Ger.)* Stelzner, F.; Baumgarten, H. G.; Holstein, A. F. (Surg. Cent., Univ. Frankfurt/Main, Germany). *Langenbecks Arch. Chir.* 336(1):35-55, 1974.

3224 INTESTINAL GAS. *(E.)* Levitt, M. D. (Univ. Minnesota Med. Sch., Minneapolis). *Postgrad. Med.* 57(1):77-84, 1975.

3225 SIMPLE CHRONIC CONSTIPATION. PATHOPHYSIOLOGY AND MANAGEMENT. *(E.)* Benson, Jr., J. A. (Univ. Oregon Med. Sch., Portland). *Postgrad. Med.* 57(1):55-64, 1975.

3226 THE SITE OF THE REDUCTION OF CHOLESTEROL TO COPROSTANOL AND THE 7α-DEHYDROXYLATION OF BILE ACIDS. *(E.)* Lai, H. Y. L.; Watne, A. L. (Dep. Pathol., West Virginia Univ., Morgantown). *Fed. Proc.* 34(3):661, 1975.

3227 ADENOMATOUS POLYPS OF THE ILEOCECAL VALVE: REPORT OF THREE CASES. *(E.)* Hildreth, D. H.; Bishop, R. P.; Johnson, T. R. (Medford Clin., Oregon). *Dis. Colon Rectum* 18(1):52-58, 1975.

3228 METASTASIS FROM A PEDUNCULATED ADENOMATOUS COLONIC POLYP WITH FOCALLY INVASIVE CARCINOMA: REPORT OF A CASE. *(E.)* Shatney, C. H.; Lober, P. H.; Sosin, H. (Univ. Minnesota Health Sci. Cent., Minneapolis). *Dis. Colon Rectum* 18(1):67-71, 1975.

3229 COLORECTAL CANCER IN CHILDREN: EPIDEMIOLOGIC ASPECTS. *(E.)* Chabalko, J. J.; Fraumeni, Jr., J. F. (Natl. Cancer Inst., Bethesda, Md.). *Dis. Colon Rectum* 18(1):1-3, 1975.

3230 COLORECTAL CANCER: METACHRONOUS AND OTHER ASSOCIATED NEOPLASMS. *(E.)* Weir, J. A. (Allan Blair Mem. Clin., Regina, Canada). *Dis. Colon Rectum* 18(1):4-5, 1975.

3231 FACTORS INFLUENCING SURVIVAL WITH COMPLETE OBSTRUCTION AND FREE PERFORATION OF COLORECTAL CANCERS. *(E.)* Peloquin, A. B. (Notre-Dame Hosp., Montreal, Canada). *Dis. Colon Rectum* 18(1):11-21, 1975.

3232 ACUTE OBSTRUCTION IN CANCER OF THE COLON AND RECTUM. *(E.)* Kronborg, O.; Backer, O.; Sprechler, M. (Bispebjerg Hosp., Copenhagen, Denmark). *Dis. Colon Rectum* 18(1):22-27, 1975.

3233 SYNCHRONOUS AND ASYNCHRONOUS CARCINOMA OF THE COLON. *(E.)* Chandler, E. R.; Morris, C. R. (St. Paul Hosp., Dallas, Texas). *Texas Med.* 71(3):60-66, 1975.

3234 LIPOMAS OF THE LARGE INTESTINE. *(Por.)* Haddad, J.; Muller, F. (Fac. Med., Univ. Sao Paulo, Brazil). *Rev. Hosp. Clin. Fac. Med. S. Paulo* 29(4):219-223, 1974.

3235 INFLAMMATORY TUMOR OF THE SPLENIC FLEXURE OF THE LARGE INTESTINE. *(Rus.)* Plisov, I. A. (Munic. Hosp. No. 3, Kimry, Kalinin Reg., USSR). *Khirurgiia (Mosk.)* (3):113-114, 1973.

3236 THE SIGNIFICANCE OF BACTERIAL STEROID DEGRADATION FOR THE ETIOLOGY OF LARGE BOWEL CANCER. I. GROWTH CONDITIONS AND NUTRITIONAL REQUIREMENTS OF SACCHAROLYTIC BACTEROIDES SPECIES. *(Ger.)* Edenharder, R. (Inst. Hyg., Mainz Univ., Germany). *Zentralbl. Bakteriol.* [*Orig. B*] 159(2):130-144, 1974.

3237 RATIONALE FOR ADOPTING THE TNM CLASSIFICATION WITH REGARD TO STATISTICAL EVALUATION OF THE PROGNOSIS FOR CANCERS OF THE LARGE INTESTINE: CONSIDERATION OF A RECENT SERIES OF 372 CASES. *(Fr.)* Roux, M. (no affil.) *Bull. Acad. Natl. Med.* 158(1):92-95, 1974.

3238 CAVERNOUS CUTANEOUS AND RECTOSIGMOID HEMANGIOMAS. BEAN'S SYNDROME. *(Fr.)* Moretti, G.; Beylot, J.; Faivre, J.; Longy, M. (St. Andre Hosp., Bordeaux, France). *Sem. Hop. Paris.* 50(25):1731-1736, 1974.

3239 RECTAL MELANOBLASTOMA. *(Rus.)* Gulin, V. A.; Perov, Iu. A. (D. I. Ulianov Med. Inst., Kuibyshev, USSR). *Klin. Khir.* (8):62-63, 1974.

3240 RECTAL AND RECTOSIGMOID CARCINOMA: PHYSICIAN'S PREDICTION OF LOCAL RECURRENCE. *(E.)* Ree, P. C.; Marks, J. E.; Moosa, A. R.; Levin, B.; Platz, C. E. (Dep. Radiol., Univ. Chicago, Ill.). *J. Surg. Res.* 18(1):1-7, 1975.

3241 HYPERSECRETING VILLOUS RECTAL TUMOR ASSOCIATED WITH WATER AND ELECTROLYTE DEPLETION. *(Sp.)* Badosa-Gallart, J.; Munoz-Agel, F. (Gallart-Mones Sch. Gastrointest. Dis., Barcelona, Spain). *Rev. Esp. Enferm. Apar. Dig.* 44(7):719-730, 1974.

3242 UNUSUAL INVOLVEMENT OF THE RECTUM BY CARCINOMA OF THE PROSTATE. *(E.)* Shin, M. S.; Witten, D. M. (Dep. Diagn. Radiol., Univ. Alabama, Birmingham). *Am. J. Dig. Dis.* 20(1):42-48, 1975.

3243 TWO CASES OF PERFORATION OF THE LARGE INTESTINE IN SIGMOID CANCER. *(Pol.)* Olech, J. (Gen. Munic. Hosp., Raciborz, Poland). *Wiad. Lek.* 27(20):1825-1826, 1974.

3244 THE ROLE OF INCOMPLETE DIVERTICULUM OF THE LARGE INTESTINE FOR DIVERTICULITIS. *(Ger.)* Schumpelick, V.; Koch, G. (Surg. Clin., Univ. Hamburg, Germany). *Langenbecks Arch. Chir.* 336(1):1-14, 1974.

3245 BLEEDING DIVERTICULOSIS OF THE COLON: A REVIEW OF 83 CASES. *(E.)* Parsa, F.; Gordon, H. E.; Wilson, S. E. (VA Wadsworth Hosp. Cent., Los Angeles, Calif.). *Dis. Colon Rectum* 18(1):37-41, 1975.

3246 DIVERTICULAR DISEASE OF THE RIGHT COLON. *(E.)* Magness, L. J.; Sanfelippo, P. M.; van Heerden, J. A.; Judd, E. S. (Mayo Clinic, Rochester, Minn.). *Surg. Gynecol. Obstet.* 140(1):30-32, 1975.

3247 INTESTINAL PARESIS AND POSTOPERATIVE ILEUS. *(Sp.)* Diez Cascon, A.; Moreno Amezcua, J. M.; Bernales, L.; Hernandez Romero, J. (Gen. Francisco Franco Residence, Barcelona, Spain). *Rev. Esp. Enferm. Apar. Dig.* 44(6):581-596, 1974.

3248 RECTAL NECROSIS FOLLOWING EXTERNAL RADIATION THERAPY FOR CARCINOMA OF THE PROSTATE: REPORT OF A CASE. *(E.)* Quan, S. H. Q.; O'Kelly, P. J. (Mem. Sloan Kettering Cancer Cent., New York, N.Y.). *Dis. Colon Rectum* 18(1):64-66, 1975.

3249 STERCORAL NECROSIS OF THE CECUM IN AN INCARCERATED RIGHT INGUINAL HERNIA: REPORT OF A CASE. *(E.)* Mehta, M.; Querubin, A. Islami, A. (St. Barnabas Med. Cent., Livingston, N.J.). *Dis. Colon Rectum* 18(1):62-63, 1975.

3250 MASSIVE LOWER GASTROINTESTINAL BLEEDING: PHYSIOPATHOLOGY, CLINICAL ASPECTS, AND TREATMENT. *(Sp.)* Meeroff, M.; Vadra, J. E. (Gallego Cent., Buenos Aires, Argentina). *Rev. Esp. Enferm. Apar. Dig.* 44(7):731-742, 1974.

3251 MASSIVE LOWER GASTROINTESTINAL BLEEDING: PATHOGENESIS. *(Sp.)* Meeroff, M.; Vadra, J. E. (Fac. Med., Natl. Univ. Buenos Aires, Argentina). *Rev. Esp. Enferm. Apar. Dig.* 44(6):621-646, 1974.

3252 ENTRAPMENT OF THE COLON FOLLOWING DIAPHRAGMATIC INJURIES: REPORT OF EIGHT CASES. *(E.)* Grodsinsky, C.; Ponka, J. L. (Henry Ford Hosp., Detroit, Mich.). *Dis. Colon Rectum* 18(1):72-78, 1975.

3253 THE IRRITABLE BOWEL SYNDROME. *(E.)* Texter, Jr., E. C.; Butler, R. C. (Univ. Arkansas Med. Cent., Little Rock). *Am. Fam. Physician* 11(3):169-173, 1975.

3254 PATHOGENETIC RELATIONS BETWEEN ACUTE INFECTIOUS ENTEROCOLITIS AND NONSPECIFIC CHRONIC ENTEROPATHY. *(Rum.)* Fodor, O.; Dimitrascu, D.; Grigorescu, M. (Inst. Med. Pharm. Cluj, Rumania). *Clujul Med.* 46(3):513-518, 1974.

3255 FATAL NECROTIZING RHINOENTERITIS: A NEW SYNDROME. *(Fr.)* Godeau, P.; Herreman, G.; de Saint-Maur, P.; Marchand, J.: Moncade, J.; Lenriot, J. P. (Cochin Hosp., Paris, France). *Nouv. Presse Med.* 3(34):2159-2164, 1974.

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3287 TOXIC HEPATOCELLULAR AND RENAL DAMAGE DURING ACUTE APPENDICITIS. *(Pol.)* Sycinski, Z. (L. Rydygier Munic. Hosp., Wroclaw, Poland). *Wiad. Lek.* 27(11):1021-1023, 1974.

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See also, 2827, 2862, 2868, 2881, 2899, 2900, 2901, 2903, 2904, 2934, 2946, 2956, 3048, 3071, 3136, 3137, 3139, 3140, 3143, 3144, 3148, 3153, 3168, 3174, 3175, 3301, 3651, 3672, 3676, 3677, 3679, 3685, 3748, 3754, 3770, 3771, 3783.

LARGE INTESTINE

Ulcerative Colitis

3290 THE SIGNIFICANCE OF ELEVATION OF SERUM CARCINOEMBRYONIC ANTIGEN (CEA) LEVELS IN INFLAMMATORY DISEASES OF THE INTESTINE. *(E.)* Booth, S. N.; King, J. P. G.; Leonard, J. C.; Dykes, P. W. (Med. Sch., Univ. Birmingham, England). *Scand. J. Gastroenterol.* 9(7):651-656, 1974.

Serial CEA measurements were made over a 12-month period in 133 patients with ulcerative colitis, 139 patients with Crohn's disease, 10 with diverticular disease and 20 with adult celiac disease. Elevated CEA levels occurred in ulcerative proctocolitis (9%), Crohn's disease (22%), and in one patient with diverticular disease. In Crohn's disease there was a significant increase in the number with persistent elevations when the history was longer than 10 yr. No significant relation to either duration or extent of disease was noted in ulcerative colitis. Transient elevations were often associated with exacerbations of the disease process. In 2 patients with ulcerative proctocolitis and in one with Crohn's disease, persistently abnormal CEA levels were associated with markedly abnormal liver function tests and abnormal hepatic biopsies. However, in 4 others with ulcerative colitis and hepatic involvement, serum CEA concentrations were normal. A rising value of 25 ng/ml was noted in one patient with completely resected Crohn's disease, but in whom steatorrhea was noted later to be associated with bacterial contamination of the small bowel and extensive jejunal diverticulosis. It is postulated that bacterial action results in enzymatic degradation of normal gastrointestinal cellular degradation products to produce or uncover an antigenic determinant identical to that on the CEA molecule. Two patients with ulcerative colitis developed a complicating carcinoma and both had normal CEA levels. It is concluded that, although CEA measurements may be valuable in cancer follow-up and possibly in the undiagnosed patient, they do not currently look promising as an indicator

of malignant complications in inflammatory bowel disease.

3291 STUDIES OF LACTIC DEHYDROGENASE CONTENT IN RECTAL MUCOSAL BIOPSIES. *(E.)* Hunt, P. S.; Dennis, P. M.; Jablonski, P.; Khoo, S. K.; McLeod, L.; Thomson, H. D. P.; Watts, J. M. (Prince Henry's Hosp., Melbourne, Australia). *Gut* 15(12): 972-976, 1974.

The total lactic dehydrogenase content and lactic dehydrogenase isoenzyme ratios were studied in homogenized rectal mucosa from 31 patients with established non-specific mucosal ulcerative colitis and from 16 normal subjects. The 31 patients included 16 males and 15 females, aged 21-72 yr, of whom 14 had active rectal disease and 17 had mild or inactive disease. Of the 14 with active disease, 8 had chronic ulcerative colitis and 6 had ileo-rectal anastomosis. The total lactic dehydrogenase content was significantly increased in patients with active ulcerative colitis when compared with patients with inactive ulcerative colitis or with normal subjects. There was a similar though not a significant increase in the slow moving isoenzymes of lactic dehydrogenase in samples of rectal mucosa from patients with active colitis. The lactic dehydrogenase isoenzyme pattern was in the normal range in 2 of the 3 patients with histological premalignant changes in rectal biopsy specimens. There was a statistically significant linear correlation between the total lactic dehydrogenase content of rectal mucosa and the carcinoembryonic antigen levels in whole serum. Both the total content and isoenzyme ratios of lactic dehydrogenase were increased in neoplastic tissue obtained from patients with carcinoma of the colon and with tissue from benign rectal polyps. It is suggested that the increased lactic dehydrogenase content may be an expression of an oxygen deficit in the mucosal cells of patients with acute ulcerative colitis, rather than an index of premalignancy.

3292 SEQUELAE OF COLECTOMY AND ILEOSTOMY: COMPARISON BETWEEN CROHN'S COLITIS AND ULCERATIVE COLITIS. *(E.)* Steinberg, D. M.; Allan, R. N.; Brooke, B. N.; Cooke, W. T.; Alexander-Williams, J. (Gen. Hosp., Birmingham, England). *Gastroenterology* 68(1):33-39, 1975.

A comparison was made between the immediate and long term mortality of colectomy and ileostomy performed in 73 patients with Crohn's colitis and 442 patients with ulcerative colitis. In Crohn's disease the immediate mortality is 4%. In ulcerative colitis it is 10%, chiefly because of the higher proportion of emergency operations in the latter disease. The late mortality in both groups is 10%, though for different reasons. Complications due to recurrent disease are a major factor in causing death of patients with Crohn's disease. Disseminated malignancy of the colon was the principal cause of late death after excisional surgery for ulcerative colitis. A further comparison was made between the postoperative course of the 64 surviving patients with Crohn's disease and a comparable sample of 65 patients who had an ileostomy for ulcerative colitis in the same time period. There was a similar incidence of postoperative septic complications in the two groups, 35%. The readmission rate was twice as high in the Crohn's disease patients. Ileostomy reconstruction for mechanical complication was required in 21 patients with Crohn's disease, compared with 6 with ulcerative colitis. Further ileal resection was necessary for recurrent disease on another 25 occasions in the patients with Crohn's disease, but never in those with ulcerative colitis. Long term review graded the clinical status as excellent or good in 70% of those with Crohn's disease compared with 95% with ulcerative colitis. These results do not condemn the operation of colectomy and ileostomy for Crohn's disease, but excisional surgery is not recommended with the same optimism as for patients with ulcerative colitis.

3293 AZATHIOPRINE IN ULCERATIVE COLITIS: FINAL REPORT ON CONTROLLED THERAPEUTIC TRIAL. *(E.)* Jewell, D. P.; Truelove, S. C. (Radcliffe Infirm., Oxford, England). *Br. Med. J.* 4(5945):627-630, 1974.

Eighty patients, all suffering from a frank clinical attack of ulcerative colitis, were part of a controlled therapeutic trial of azathioprine. The attack was treated with a standard course of corticosteroids. For outpatients, oral prednisolone was given 5 mg four times a day and prednisolone disodium retention enema nightly. The inpatients were given prednisolone 21-phosphate 40 mg/day in the i.v. fluid, tetracycline 1 g/day in divided doses in the i.v. fluid, and rectal drip of hydrocortisone hemisuccinate sodium 100 mg twice daily. If clinical response was good, feeding was resumed and oral prednisolone, 40 mg/day was given in divided doses. When discharged the patients were placed on the outpatient regimen. In addition to this standard corticosteroid course, the patients were immediately placed on treatment with either azathioprine in a dose of 2.5 mg/kg or dummy tablets. Trial tablets were continued for 1 yr. If a patient relapsed, a further course of corticosteroids was given without interrupting maintenance treatment with azathioprine. During azathioprine, side effects were few and not dangerous. No example of frank bone-marrow supression was noted. One patient developed nausea, abdominal discomfort, and diarrhea. One developed a generalized erythematous rash. Patients on azathioprine had a greatly reduced production of plasma cells and K cells. In the treatment of an actual attack of ulcerative colitis, results indicate that no benefit came from adding azathioprine to the standard corticosteroid therapy. Patients admitted in their first attack showed no benefit from the 1 yr maintenance with azathioprine, the benefits of which were confined to patients admitted in a relapse of established disease. Even in these, the difference between treated and control patients failed to reach statistical significance, but the difference was great enough to suggest there is a prima facie case for regarding azathioprine as of some benefit in this group of patients.

3294 ELECTRICAL POTENTIAL DIFFERENCE AND ABSORPTION OF WATER, SODIUM, AND POTASSIUM BY THE TERMINAL ILEUM OF ILEOSTOMY PATIENTS. *(E.)* de Moraes Filho, J. P.; Salas-Coll, C.; Blendis, L.; Edmonds, C. J. (Cent. Middlesex Hosp., London, England). *Gut* 15(12):977-981, 1974.

Measurements of electrical potential difference and of absorption by a dialysis method were carried out in the terminal ileum of 11 patients (7 males and 4 females, aged 24-54 yr) with an ileostomy. The studies were performed between 2 weeks and 6 yr after formation of the ileostomy. In 6 patients the potential difference measured 3 cm from the ileostomy stoma showed a mean of 14.3 mV, compared to a mean of 9.2 mV when measured at 10 cm from the stoma. The potential difference thus appeared to be significantly increased close to the stoma. In 5 patients the potential difference was measured repeatedly over a period of 8 months with very little variation observed. The time for which the ileostomy had been established also appeared to have little effect on the potential difference. The measured potential difference increased considerably when glucose was added to the luminal solution, even though osmolality was kept constant. The effect was reversed rapidly when the glucose-containing solution was removed. A concentration of 10 nM/liter of glucose had little effect, while a maximum effect was achieved with 40 nM/liter. In 11 subjects in the presence of glucose the potential difference had a mean value of 18.7 (SEM), while without glucose the value was 8.3 (SEM). Reducing the luminal sodium concentration from 130 to 13 nM/liter was consistently associated with a fall of potential difference from a mean of 9.4 to 2.1 mV, which reversed when sodium was reintroduced. With a saline bicarbonate solution (sodium 145 or 140 mEq/liter, K 5, or 10 mEq/liter) in the dialysis tube, considerable absorption of fluid and sodium was demonstrated with little change in sodium concentration. Potassium secretion occurred with the lower, and absorption with the higher, concentration. The final luminal potassium concentration reached was consistent with a passive distribution between blood and lumen. It was concluded that the ileal mucosa, beyond the first few centimeters of the stoma of an ileostomy, behaves similarly to the ileum of the intact gut in regard to potential difference, water, sodium, and potassium transport. The relatively simple methods available for study of the accessible part of the ileum after ileostomy, offer a useful means of examining the action of drugs and hormones and of testing the functional state of the ileum epithelium.

3295 IMPAIRMENT OF 'ILEOSTOMY ADAPTATION' IN PATIENTS AFTER ILEAL RESECTION. *(E.)* Hill, G. L.; Mair, W. S. J.; Goligher, J. C. (Gen. Infirm., Leeds, England). *Gut* 15(12):982-987, 1974.

Ileostomy adaptation was studied in 10 patients (4 women and 6 men, aged 26-63 yr) diagnosed with granulomatous disease (4) or ulcerative colitis (6). Ileostomy and proctocolectomy were performed on 8 patients, 3 of whom also underwent ileal resections. Ileostomy, right hemicolectomy, and ileal resections were performed on the remaining 2. For the group as a whole, there was no significant decrease in the ileostomy volume over the 6-month period, nor was any significant intestinal adaptation uncovered by i.v. saline loading. However, marked difference in the mean daily fecal output of resected patients was noted. For nonresected patients the mean daily fecal output during postoperative days 7-11 was 456 ml compared with 909 for resected patients. At 6 months the low daily fecal output of 430 ml for the nonresected group was significantly different from the high output of 1105 ml for resected patients. Although there was no response to i.v. saline loading in the resected group, there was a significant increase in the mean daily fecal volume in nonresected patients, from 430 to 553 ml. This indicates that the resected group not only had a higher mean daily fecal volume from the outset, but also that no meaningful adaptation of the intestine had occurred in the 6 months. Patients in whom the terminal ileum was preserved had not only a smaller volume ileostomy from the outset, but at 6 months intestinal adaptation was noted when the extracellular fluid volume was rapidly expanded by i.v. saline loading. Whereas there was a significant thickening of the ileostomy fluid after 6 months in patients with low volume ileostomies, no such decrease in water content was noted in those with a high volume ileostomy. There was no apparent conservation of sodium in either group over the 6 months, but after i.v. saline there was a significant increase in daily output and concentration of sodium in nonresected patients. The daily fecal output of potassium was not significantly different for any of the time periods or between either group. After 6 months, the sodium:potassium ratio in the urine was lower for resected patients, suggesting this group was conserving sodium more than the nonresected patients. The reverse is true for feces. Whereas urine conservation of sodium occurs at the renal tubule in the resected group at 6 months, this did not occur in the intestine. It appears that the response by the intestine to conserve sodium is no longer present in resected patients over the 6-month period, whereas this conservation process had persisted in the nonresected patients. There is no doubt that patients with an ileal resection can conserve fluid and sodium from the intestine, but the stimulus to do so apparently must be particularly strong.

3296 MUCOSAL-CELL COUNTS IN ULCERATIVE AND GRANULOMATOUS COLITIS. *(E.)* Sommers, S. C.; Korelitz, B. I. (Lenox Hill Hosp., New York, N.Y.). *Am. J. Clin. Pathol.* 63(3):359-365, 1975.

Epithelial and connective-tissue cells were counted in rectal mucosal biopsies from 215 patients with ulcerative colitis, 98 with granulomatous colitis and 50 controls. Significantly decreased mucous goblet cells were found both in sigmoidoscopically abnormal ulcerative colitis and in granulomatous colitis, and they increased during the healing process. More pyknotic and karyorrhectic epithelial cells occurred in active ulcerative colitis than in granulomatous

colitis. Inactive ulcerative colitis still manifested histologic evidence of acute and chronic inflammation, while sigmoidoscopically normal granulomatous colitis biopsies after previous gross rectal disease showed significantly increased macrophages in the lamina propria. Cell counts were valuable for differential diagnosis after the sigmoidoscopic appearance became normal. To identify specific influences of medication, ulcerative colitis groups treated with salicylazosulfapyridine, prednisone, or 6-mercaptopurine were analyzed. Salicyazosulfapyridine therapy was associated with an overall decrease in mucosal leukocytes. Significantly decreased neutrophils were found after prednisone or 6-mercaptupurine, decreases in plasma cells occurred after all three types of therapy, and increased mast cells were found after 6-mercaptopurine. All three combinations of any two of these drugs were associated with significantly decreased plasma cells. Combinations of 6-mercaptopurine with either prednisone or salicylazosulfapyridine was correlated with increased macrophages. Prednisone with salicylazosulfapyridine was associated with significantly increased mast cells. The results of this study support the statement that colonic mucous goblet cells are reduced in active ulcerative colitis. Further, while the leukocytic exudates of these inflammatory intestinal diseases in active states differed only in the more abundant eosinophils in granulomatous colitis, in quiescent states ulcerative colitis and granulomatous colitis connective-tissue-cell populations were distinctive, with persisting exudative inflammation in ulcerative colitis and mobilized macrophages in granulomatous colitis.

3297 RED CELL ABNORMALITIES ASSOCIATED WITH SULPHASALAZINE MAINTENANCE THERAPY FOR ULCERATIVE COLITIS. *(E.)* Pounder, R. E.; Craven, E. R.; Henthorn, J. S.; Bannatyne, J. M. (Cent. Middlesex Hosp., London, England). *Gut* 16(3):181-185, 1975.

Red cell abnormality occurring in patients receiving sulphasalazine was studied to determine the incidence of such changes. Hematological studies were performed on blood samples taken from 50 patients receiving a mean dose of 2.5 g sulphasalazine/day as maintenance therapy for ulcerative colitis, 10 patients with ulcerative colitis not receiving sulphasalazine and 50 controls. Red cell morphology was assessed independently by two observers. Of the treated patients, 35 were found to have one or more drug-induced abnormalities not found in controls or in untreated patients. Contracted red cells were observed in 23 of the treated patients; the abnormality was related to the dose of sulphasalazine, the serum total sulphapyridine level, and acetylator status. Of the treated patients, 11 had a macrocytosis, 21 had elevated levels of methemoglobin, and one had Heinz bodies. A dose of 1.5 g sulphasalazine/day was not associated with red cell contraction, and is suggested as a safer dose for the long-term treatment of the asymptomatic colitis.

3298 THE THYROID IN ULCERATIVE COLITIS AND CROHN'S DISEASE. II. THYROID ENLARGEMENT AND HYPERTHYROIDISM IN ULCERATIVE COLITIS. *(E.)* Jarnerot, G.; Azad Khan, A. K.; Truelove, S. C. (Radcliffe Infirm., Oxford, England). *Acta Med. Scand.* 197(1/2):83-87, 1975.

The incidence of thyroid disease was surveyed in 300 patients with ulcerative colitis and 600 matched controls. The subjects were assessed for simple goiter type thyroid enlargement. A significant increase in frequency of simple goiter was observed in the ulcerative colitis patients (8.7%) compared with 4.3% in the controls. A history of thyrotoxicosis was obtained in 3.7% of the ulcerative colitis patients compared with 0.8% of the controls. In more than half the ulcerative colitis patients with a history of hyperthyroidism, the hyperthyroidism occurred years before the onset of the colitis, suggesting that hyperthyroidism is not likely to be a complication of colitis. Possible explanations for the association of the two diseases are discussed, but it is concluded that no satisfactory explanation has yet been offered.

3299 ULCERATIVE COLITIS. FOLLOW-UP OF 160 PATIENTS OBSERVED FOR AN AVERAGE OF 10 1/2 YEARS. *(Ger.)* Fahrlander, H.; Shalev, E. (Med. Dep., Univ. Basel, Switzerland). *Dtsch. Med. Wochenschr.* 99(43):2141-2147, 1974.

3300 BLEEDING RECTAL POLYPS AS A REASON FOR FALSE POSITIVE DIAGNOSIS OF NONSPECIFIC ULCERATIVE COLITIS IN CHILDREN. *(Rus.)* Kanshina, O. A.; Kanshin, N. N. (A. V. Rusakov Munic. Clin. Hosp. Child., Moscow, USSR). *Sov. Med.* (12):98-102, 1973.

3301 SURGICAL TREATMENT OF NONSPECIFIC INFLAMMATION OF THE LARGE INTESTINE. *(Pol.)* Goral, R.; Sniezynski, C.; Rychlewski, W.; Kociecka, W. (Acad. Med., Poznan, Poland). *Przegl. Lek.* 31(3):405-408, 1974.

3302 SURGICAL TREATMENT IN ULCERATIVE COLITIS. *(E.)* Rumpf, P. Kremer, K.; Jacobs, G.; Ulrich, B.; Hoffmann, E. (Surg. Clin., Univ. Dusseldorf, Germany). *Bruns Beitr. Klin. Chir.* 221(6):451-452, 1974.

See also, 2902, 3256, 3373, 3658, 3774.

3303 MALABSORPTION OF VITAMIN B_{12} WITH EXOCRINE PANCREATIC INSUFFICIENCY. *(Ger.)* Aenishanslin, H. W.; Stalder, G. A. (Med. Polyclin., Univ. Basel, Switzerland). *Schweiz. Med. Wochenschr.* 104(39):1377-1379, 1974.

Exocrine pancreatic function and vitamin B_{12} absorption, with and without intrinsic factor, were studied in 10 patients, aged 25-64 yr, with histories of chronic pancreatitis dating back 3-120 months. Three patients had malabsorption of vitamin B_{12}, both in the presence and absence of intrinsic factor, while 3 others had malabsorption of the vitamin B_{12}-intrinsic factor complex. Trypsin activities in intestinal juice were significantly decreased in patients with malabsorption of vitamin B_{12} in the presence and absence of intrinsic factor. These findings suggest that vitamin B_{12} malabsorption might have been caused by trypsin deficiency in these patients. In the 3 patients with malabsorption of the vitamin B_{12}-intrinsic factor complex, the findings could be explained if trypsin (1) facilitated binding between intestinal receptors in the ileum and the vitamin B_{12}-intrinsic factor complex and (2) split a hypothetical "binder" which blocks the vitamin B_{12}-intrinsic factor complex. None of the patients with reduced vitamin B_{12} absorption had macrocytic anemia. This is attributed to substitution therapy with trypsin.

3304 EXOCRINE PANCREATIC INSUFFICIENCY IN THE ABSENCE OF CYSTIC FIBROSIS IN INFANTS AND CHILDREN. *(Ger.)* Niessen, K. H.; Osswald, P.; Schmidt, K.; Hartmann, F.; Droste, E.; Brugmann, G. (Pediatr. Clin., Univ. Tubingen, Germany). *Monatschr. Kinderheilk.* 122(7):560-561, 1974.

Pancreatic function was tested in 54 patients, aged 2 months to 16 yr by the secretin-pancreozymin method. Six patients showed reduced enzyme activity, although cystic fibrosis was ruled out by several sweat tests. The cause of pancreatic insufficiency apparently differed in these 6 patients: 3 infants at age 2 months had mucosal atrophy. In one, this probably resulted from celiac disease with secondary pancreatic insufficiency, in another, probably from chronic fibrotic pancreatitis. The third child developed symptoms of pancreatic insufficiency as a result of acute pancreatitis caused by parasite infestation. One child suffered from intermittent neutropenia and increased vulnerability toward infection as in the Shwachman-Diamond syndrome. There was also a case of dwarfism, but no neutropenia or skeletal changes could be detected. Total bile acids in the intestinal juice were reduced in 2 and in the lower normal range in 1 of the patients with pancreatic insufficiency. Bile acid secretion was primarily decreased in the secretin phase. During the secretin-pancreozymin test, patients with total atrophy of the villi secreted significantly larger quantities of bile acids into the intestinal juice than 28 children with normal mucosa or partial atrophy of the villi.

3305 VASOACTIVE INTESTINAL POLYPEPTIDE IN VERNER-MORRISON SYNDROME. *(Ger.)* Seif, F. J.; Sadowski, P.; Heni, F.; Fischer, R.; Bloom, S. R.; Polak, J. M. (Med. Polyclin., Univ. Tubingen, Germany). *Dtsch. Med. Wochenschr.* 100(9):399-405, 1975.

A 40-yr-old man who had been treated for a stomach ulcer 4 yr previously and who had a family history of cancer was hospitalized with intractable diarrhea, hypokalemia, pentagastrin-refractory hypochlorhydria, and reduced pancreatic secretion of bicarbonate, trypsin, chymotrypsin, amylase, and lipase. Radioimmunological studies showed a plasma concentration of vasoactive intestinal polypeptide (VIP) of 800 pg/ml (normal < 100 pg/ml). Plasma concentrations of gastrin-inhibiting polypeptide (GIP), pancreatic glucagon, secretin, and gastrin were all within normal limits. At laparoscopy, multiple metastases were found in the right lobe of the liver, but the type of primary tumor could not be established histologically. Diarrhea did not respond to cytostatic therapy with 5-fluorouracil and cyclophosphamide; symptomatic therapy with tincture of opium, charcoal, pancreatic enzymes, and acid substitution; 0.625 mg pentagastrin s. c. every 3 hr for 3 days; serotonin antagonists and inhibitors of serotonin synthesis (8 mg cyproheptadine 4 times a day, 4 mg methysergid twice a day, 1000 mg DL-*p*-chlorophenylalanine 4 times a day); or prostaglandin synthetase inhibitors (500 mg acetylsalicylic acid 3 times a day, 100 mg indomethacin 3 times a day). Improvement in the diarrhea occurred only with daily infusions of 500 ml of concentrated amino acid solution. Diarrhea ceased and parenteral correction of the water and electrolyte balance became unnecessary 36 hr after administration of 100 mg prednisolone 21-succinate sodium i. v. followed by 10 mg fluocortolone p. o. every 6 hr, but subclinical diabetes mellitus became manifest and was treated with 12 IU depot insulin twice a day. At surgery, a primary non-β-cell islet carcinoma which was strongly positive for VIP was removed from the head of the pancreas; the right lobe of the liver was partially resected; and a cholecystectomy was performed. Lymph node metastases were found at the root of the mesentery and the porta hepatis. Diarrhea did not recur when prednisolone 21-succinate sodium and ACTH were discontinued 1 week after surgery, and plasma VIP concentrations decreased to normal levels. However, the patient developed abdominal abscesses and died of septic cardiovascular failure 68 days after surgery.

3306 POSSIBLE PARATHYROID ORIGIN OF GASTRIN IN A PATIENT WITH MULTIPLE ENDOCRINE ADENOPATHY TYPE I. *(E.)* Cassar, J.; Polak, J. M.; Cooke, W. M. (Hammersmith Hosp., London, England). *Br. J. Surg.* 62(4):313-316, 1975.

A 52-yr-old woman with multiple endocrine adenopathy type I (pituitary, parathyroids, and islet cells) presented with spontaneous hypoglycemia that resolved after removal of two large pancreatic insulinomas, 1 in the tail and the other in the body of the pancreas. Shortly after her discharge the patient was readmitted with severe epitastric pain, hematemesis, and melena. Despite a rise in serum gastrin, there was no evidence of a gastrin-producing tumor. The serum gastrin remained high

after truncal vagotomy and pylorplasty were carried out for a bleeding duodenal ulcer and after an antrectomy was performed due to persistent melena. After antrectomy, the basal acid output was 3.1 mEq/hr; peak acid output in response to pentagastrin, 11.3 mEq/hr; and fasting gastrin, 538 pg/ml. The serum gastrin level remained high until hypercalcemia and hyperparathyroidism had been corrected by subtotal parathyroidectomy. In the resected portions of the parathyroid glands, there was diffuse hyperplasia affecting both chief and oxyphil cells. The latter were identified by the presence of numerous mitochondria (mitochondrion-rich cells) and contained electron-dense polymorphic secretory granules predominantly localized toward the vascular poles of the cells. Antiserum against human parathyroid hormone showed reactive chief cells scattered throughout the glands and concentrated around blood vessels. Most of the oxyphil cells were stained positively with an antiserum against human gastrin I. This finding suggests that these cells were the source of the gastrin.

3307 PANCREATIC ABSCESS: A CRITICAL ANALYSIS OF 113 CASES. *(E.)* Camer, S. J.; Tan, E. G. C.; Warren, K. W.; Braasch, J. W. (Lahey Clin. Found., Boston, Mass.). *Am. J. Surg.* 129(4):426-431, 1975.

Records of 113 patients (48 women and 65 men, aged 35-76 yr) with pancreatic abscess were reviewed in an effort to define diagnostic, therapeutic, and prognostic parameters of importance in the management of this disorder. The cases, seen over a 23-yr period, were analyzed in terms of signs, symptoms, and laboratory data, bacteriologic, radiologic, and operative findings, and management. Of the 107 patients who underwent operative drainage, 17.7% died. Complications were varied and often multiple, only 24 patients having and entirely smooth course. Complications included hemorrhage, pulmonary problems, renal and hepatic failure, postoperative fistula, postoperative gastric retention, prolonged ileus, and residual abscess requiring operative drainage. Among 88 survivors, there were 12 known deaths within the first 6 months. Deaths were due to pancreatic carcinoma, duodenal carcinoma, chronic inanition and spesis, adrenal insufficiency, liver failure, and myocardial infarction. Forty-nine patients are alive, 30 of whom have been asymptomatic or have had mild symptoms of no functional significance. Seventeen patients required further operations on the pancreas and biliary system and 19 patients have pain and symptoms of pancreatic insufficiency. Useful diagnostic aids include radiographic examination, selective visceral angiography, and ultrasonic scanning. Successful management involves a timely, aggressive surgical approach, with wide debridement and sump drainage and liberal use of supportive measures such as feeding jejunostomy, gastrostomy, colloid infusion, and enteral and parenteral hyperalimentation.

3308 MORPHOLOGICAL CHANGES IN THE PANCREAS IN SYSTEMIC LUPUS ERYTHEMATOSUS AND SYSTEMIC SCLERODERMA. *(Rus.)* Skorodumova, N. P. (Donetsk Med. Inst., USSR). *Vrach. Delo* (2):32-36, 1975.

Histological studies were performed on sections from the head, body, and tail of the pancreas, major pancreatic artery, and large pancreatic veins from 204 autopsies of collagen patients, of whom 50 had systemic lupus erythematosus (SLE) and 25 had systemic scleroderma (SS). The pancreas was affected in 20 cases of SLE and in nine cases of SS. Changes were observed in all the structural components of the pancreas (vessels, stroma and parenchyma). The most significant changes were found in the intrapancreatic ramifications of the pancreatic artery in the form of mucoid swelling, fibrinoid changes, cellular reactions and sclerosis. Changes in the veins consisted of either a moderate or marked sclerosis of the walls, edema and small lymphoid infiltrates in the outermost layer. Sclerosis of the walls of the veins prevailed in SS, while edema and cellular infiltration were more characteristic of SLE. The foci of mucoid and fibrinoid swelling were characteristic dystrophic changes of the pancreatic stroma in SLE, while pronounced sclerotic processes in the stroma, the walls of the ducts and perivascular tissue were more characteristic of SS. Atrophic and dystrophic changes were observed in the pancreatic parenchyma. A correlation was observed between the changes in the parenchyma and the vessels. This suggests a possible secondary involvement of the parenchyma in the pathological process.

3309 PANCREATIC EXTRACTS IN THE TREATMENT OF PANCREATIC EXOCRINE INSUFFICIENCY. *(E.)* Saunders, J. H. B.; Wormsley, K. G. (Dep. Therap., Univ. Dundee, Scotland). *Gut* 16(2):159-162, 1975.

3310 FOLLOWUPS OF PANCREATIC INSUFFICIENCY TREATED WITH PANPUR SUBSTITUTION THERAPY: USE OF THE FECAL LIPID PATTERN. *(Ger.)* Erb, W.; Siede, W. (Cent. Intern. Med., Johann Wolfgang Goethe Univ., Frankfurt/Main, Germany). *Z. Gastroenterol.* 13(1):35-43, 1975.

3311 ANTIBIOTICS AND FAECAL TRYPTIC ACTIVITY. *(E.)* Morrison, P. S.; Barnes, G. L. (St. Bartholemew's Hosp., London, England). *NZ Med. J.* 80(530):544-546, 1974.

3312 ANNULAR PANCREAS IN THE ADULT. *(E.)* Olin, R.; Norum, H. A. (Dep. Intern. Med., Fargo Clin., N.D.). *Minn. Med.* 58(3):248-250, 1975.

3313 NECROTIC PANCREATIC PSEUDOCYST ACCOMPANIED BY DYSPHAGIA AND STENOSIS OF THE CELIAC TRUNK. *(Fr.)* Latreille, R.; Bodin, J. P.; Le Toublon, C. (Grenoble Reg. Hosp. Cent., La Tronche, France). *Lyon Chir.* 70(4):256-258, 1974.

3314 SURGERY FOR EXTERNAL PANCREATIC FISTULAS. *(Rus.)* Danilov, M. V. (A. V. Vishnevskii Inst. Surg., Moscow, USSR). *Khirurgiia (Mosk.)* (3): 112-113, 1974.

3315 PANCREAS REJECTION IN COMBINED PANCREATICODUODENAL AND RENAL ALLOTRANSPLANTATION IN MAN. *(E.)* Largiader, F.; Uhlschmid, G.; Binswanger, U.; Zaruba, K. (Canton. Hosp., Zurich, Switzerland). *Transplantation* 19(2):185-187, 1975.

3316 FUNCTIONAL DISTURBANCES OF THE PANCREAS CAUSED BY TOXIC CHEMICALS. *(Rus.)* Kleiner, A. I.; Vasilenko, N. M.; Sonkin, I. S.; Ostrovskaia, I. S.; Iashina, L. N.; Liss, N. L. (Inst. Ind. Hyg. Occupational Dis., Kharkov, USSR). *Gig. Tr. Prof. Zabol.* (10):15-18, 1974.

3317 CARCINOMA OF THE PANCREAS. RESULTS FROM THE VERMONT TUMOR REGISTRY. *(E.)* Leadbetter, A.; Foster, Jr., R. S.; Haines, C. R. (Univ. Vermont Coll. Med., Burlington). *Am. J. Surg.* 129(4):356-360, 1975.

3318 SURGICAL TREATMENT OF PANCREATIC CYSTS. *(Rus.)* Dobychina, L. I.; Trunin, M. A. (Leningrad Sanit. Hyg. Med. Inst., USSR). *Vest. Khir.* (3):29-32, 1975.

3319 IMPAIRED DIGESTION: ITS CAUSES, DIAGNOSIS, AND TREATMENT. *(Ger.)* Worning, H. (Glostrup Hosp., Denmark). *Z. Gastroenterol.* 13(Suppl.): 158-165, 1975.

See also, 2405, 2573, 2861, 2867, 2872, 2878, 2883, 2905, 2906, 2907, 2908, 2912, 2918, 2945, 2949, 2961, 2963, 2966, 2967, 3012, 3080, 3112, 3188, 3327, 2618, 3704.

PANCREAS

Pancreatitis

3320 CHRONIC PANCREATITIS, SCLEROSING CHOLANGITIS, AND SICCA COMPLEX IN TWO SIBLINGS. *(E.)* Waldram, R.; Tsantoulas, D.; Kopelman, H.; Williams, R. (King's Coll. Hosp., London, England). *Lancet* 1(7906):550-552, 1975.

A new syndrome of chronic pancreatitis, sclerosing cholangitis, sicca complex, and other features was found in a brother and sister, aged 36 and 31 yr, resp. The woman's history of difficulties extended over a 5 yr period; the brother had had intermittent epigastric pains from the age of 10. In both, the main features were now those of chronic pancreatitis and sclerosing cholangitis. Additionally, the brother had sialectasis, generalized lymphadenopathy, and moderate leukopenia, while the sister showed the histological and clinical features of sicca complex and eosinophilia. Obstruction of the lower end of the common bile duct, a very rare complication of chronic pancreatitis, was present in both patients. Leucocyte migration was measured in these 2 cases as part of a larger study of cellular immunity in patients with chronic liver disease. In 4 of 5 cases of sclerosing cholangitis, including both of these presently reported cases, migration was significantly inhibited. Leukocytes from their parents and from one of the 2 apparently healthy siblings migrated normally in the presence of the bile antigen. Migration inhibition has not been found in patients with extrahepatic obstruction due to gallstones or pancreatic carcinoma. The bile antigen has been shown to be derived from the bile duct epithelial cells, and the finding of cellular immunity to this material in sclerosing cholangitis suggests that immune mechanisms may be important in the pathogenesis of this disease.

3321 THE AETIOLOGY OF HYPOCALCAEMIA IN ACUTE PANCREATITIS. *(E.)* Condon, J. R.; Ives, D.; Knight, M. J.; Day, J. (St. Mary's Hosp., Eastbourne, England). *Br. J. Surg.* 62(2):115-118, 1975.

The mechanism of hypocalcemia in acute pancreatitis was investigated in 30 patients. Parathyroid hormone was assayed in 11 of 12 hypocalcemic patients and three of 18 normocalcemic patients. Calcitonin was assayed in three of the hypocalcemic patients. Glucagon was assayed in all of the above and in 12 additional normocalcemic patients, 11 of whom had measurements made before and after administration of glucagon (1 mg i.v. followed by 1-1.5 mg 4-hourly i.v. infusion). All measurements were made by radioimmunoassay. Parathyroid hormone was undetectable in the plasma of eight hypocalcemic patients (calcium 7.8 mg/100 ml). One hypocalcemic patient had an elevated parathyroid hormone level of 675 pg/ml. One hypocalcemic and two normocalcemic (9.0-9.9 mg/100 ml) patients had parathyroid hormone levels of 100-175 pg/ml. Three subjects showed serial changes in parathyroid hormone level. One showed a drop from 1.5 ng/ml to 0.5 ng/ml along with a calcium level drop of 8.9 to 8.5 mg/100 ml within 24 hr. A second was normocalcemic with a high parathyroid hormone level that fell gradually. The third was hypocalcemic initially, but both the parathyroid hormone

level and calcium level rose; glucagon administration did not result in hypocalcemia in these last two. Calcitonin was not detected in three of the hypocalcemic patients. Mean fasting glucagon levels were 0.48 in 15 normal subjects, and 0.45 in 26 pancreatitis patients. After glucagon infusion, plasma glucagon rose significantly by 3.4-4.0 ng/ml in 1 hr except in two patients. Plasma calcium fell significantly from 0-12 hr, while there was no significant difference in glucagon levels from 1-12 hr. Between 0 and 1 hr, the greater the increase in glucagon concentration, the smaller the fall in plasma calcium. There was no such relationship at 12 hr. It is concluded that persistent hypocalcemia associated with acute pancreatitis is due to a relative deficiency of parathyroid hormone level and is unrelated to glucagon and calcitonin levels.

3322 LIPODYSTROPHY, PANCREATITIS, AND EOSINOPHILIA. *(E.)* Smith, P. M.; Morgans, M. E.; Clark, C. G.; Lennard-Jones, J. E.; Gunnlaugsson, O.; Jonasson, T. A. (Univ. Coll. Hosp., London, England). *Gut* 16(3):230-234, 1975.

Two cases are presented of partial lipodystrophy associated with pancreatitis and eosinophilia. In each case the onset of the lipodystrophy was at the age of 5 yr. In one case, recurrent eosinophilia was associated with episodes of recurrent acute pancreatitis. There was also an attack of left renal pain, followed by a temporary impairment of renal function at one point. In the second case there was chronic pancreatitis associated with eosinophilic gastroenteritis. Bilateral non-obstructive hydronephrosis was also diagnosed. Partial lipodystrophy is commonly associated with renal disease, but has never before been associated with pancreatitis. It is suggested that in these cases the eosinophilia was associated with the pancreatitis, but no conclusions are drawn between the interrelationship of the pancreatitis, eosinophilia, and lipodystrophy.

3323 INTENSIVE CARE IN ACUTE PANCREATITIS. *(Ger.)* Schonborn, H. (2nd Med. Clin., Univ. Mainz, Germany). *Langenbecks Arch. Chir.* 245-250, 1974.

Of 20 patients who died of acute pancreatitis despite intensive care, all had hemorrhagic necrotizing pancreatitis. Acute renal failure, acute encephalopathy (both of which are irreversible), and shock are indicative of fatal pancreatitis. In patients who survived for less than 12 days, these symptoms manifested themselves within the first 3 days of illness. A pancreatectomy (Child) was performed on 10 patients with total necrosis of the pancreas. Four patients died. Of the 6 that survived, all had normal renal function at the time of operation. It is concluded that severe cases of pancreatitis which might prove fatal should be operated on as soon as possible, and no later than the 6th to 8th day of illness.

3324 ANTINUCLEAR FACTORS IN PATIENTS WITH PANCREATITIS OF UNKNOWN ETIOLOGY. ARE THERE CLEAR INDICATIONS OF AN IMMUNOLOGICAL GENESIS? *(Ger.)* Neher, M.; Lemmel, E. M. (Surg. Clin., Univ. Mainz, Germany). *Dtsch. Med. Wochenschr.* 100(8):362-367, 1975.

Indirect immunofluorescence was used to determine antinuclear antibodies in sera from 31 patients with pancreatitis. The cause of the pancreatitis (trauma, biliary disease, alcohol abuse) was known in 20 cases and unknown in 11. None of these patients had any other diseases, such as systemic lupus erytheomatosus or liver disease, which are known to be accompanied by the production of antinuclear antibodies. Antinuclear antibodies were present, in most cases in high titers, in 8 of 22 patients with chronic pancreatitis and in 4 of 9 patients with acute pancreatitis. These antinuclear antibodies were shown to consist of IgG and IgM. Of the 11 patients with pancreatitis of unknown etiology, 9 had positive tests for antinuclear antibodies, while only 3 of the 20 with pancreatitis of known etiology had positive tests. With 1 exception, antinuclear antibodies were present in the first sample of serum taken from patients with acute pancreatitis. These findings suggest that some forms of pancreatitis might be autoimmune in nature.

3325 SECRETIN-PANCREOZYMIN TEST. *(Ger.)* Tymptner, F.; Domschke, W.; Koch, H.; Demling, L. (Med. Clin., Univ. Erlangen-Nuremberg, Erlangen, Germany). *Dtsch. Med. Wochenschr.* 99(32):1611-1615, 1974.

After placing a Lagerlof tube in the stomach and duodenum, the secretin-pancreozymin test was performed on 50 normal subjects (29 men and 21 women; mean age 33.2 yr); 34 patients (23 men and 11 women; mean age 38.7 yr) 3-8 weeks after the onset of acute pancreatitis; 48 patients (38 men and 10 women; mean age 41.5 yr) with chronic pancreatitis; 86 patients (51 men and 35 women; mean age 47.3 yr) suspected of having pancreatic disease; and 15 patients (11 male and 4 female; mean age 23.6 yr) with juvenile diabetes. During the entire 2.5 hr, a ^{58}Co-labeled vitamin B_{12} solution (0.7 μCi in 28 ml 0.9% NaCl) was instilled into the duodenum. By measuring the radioactivity of secretion aspirated from the stomach and intestine, 0-12% (mean 4.5%) and 11-97% (mean 49.8%), resp., of the ^{58}Co-labeled vitamin B_{12} was recovered. After i.v. administration of secretin, the enzyme output first increased above the basal value and then decreased. Enzyme output increased during infusion of secretin and pancreozymin and then remained almost constant. In controls, the bicarbonate output ranged from 12.4-43.1 mEq/hr (mean 23.1); the trypsin output, from 85-391 IU/min (mean 183); the chymotrypsin output, from 41-251 U/min (mean 102); the amylase output, from 440-2189 IU/min (mean 982); the lipase output, from 901-4865 IU/min (mean 2093); the protein output, from 0.48-4.76 g/hr (mean 1.51); and the bilirubin output, from 1.89-171.0 mg/hr (mean 18.0). Results of the secretin-pancreozymin test were abnormal in 62% of the patients recovering from acute pancreatitis, in all 48 patients with chronic pancreatitis; and in 10 of the 15 patients (66%) with

juvenile diabetes. None of the 68 patients suspected of having pancreatic disease who had normal secretin-pancreozymin tests had pathological findings on endoscopic pancreatography. Of the remaining 33 patients with abnormal secretin-pancreozymin tests, 11 had radiological evidence of chronic pancreatitis; six had papillary stenosis and five, pancreatic cysts at surgery. Four patients had inoperable pancreatic carcinoma, and one young patient had cystic fibrosis which was diagnosed by determining sweat electrolytes.

3326 A BRITISH FAMILY WITH HEREDITARY PANCREATITIS. *(E.)* Sibert, J. R. (R. Victoria Infirm., Newcastle-upon-Tyne, England). *Gut* 16(2): 81-88, 1975.

A British family with hereditary pancreatitis was studied. The disease was definitely diagnosed in 9 members (by clinical signs, a raised serum amylase, or laparotomy, and once by pancreatic calcification seen radiographically) and was suspected in 15 others. The clinical signs included recurrent attacks of epigastric or central abdominal pain, sometimes radiating to the back, often associated with vomiting, and usually lasting 3-4 days. These attacks generally started in childhood or young adult life (mean age of onset in this group was 12.6 yr) and ceased by the age of 40. The pattern of inheritance in this family corresponds well with an autosomal dominant inheritance with incomplete penetrance, which agreed with previously reported families. However, unlike in some previous reports, there was no aminoaciduria in this particular family. It is suggested that hereditary pancreatitis may have been underdiagnosed in Great Britain, and the increased awareness may aid in the differential diagnosis of relapsing pancreatitis, especially in children and young adults.

3327 FRUSEMIDE-INDUCED PANCREATITIS. *(E.)* Jones, P. E.; Oelbaum, M. H. (Manchester North Hosp., London, England). *Br. Med. J.* 1(5950): 133-134, 1975.

A case of acute pancreatitis in which furosemide (frusemide) was implicated as the etiological agent was reported in a 64-yr-old female hospitalized with a myocardial infarction complicated by mild left ventricular failure. After receiving 80 mg/day furosemide for 4 weeks, the patient developed hiccuping, eructations, upper abdominal discomfort, and vomiting. Serum amylase was elevated (80 U/100 ml), as was the serum lipase (3.3 U/ml), and a diagnosis of acute pancreatitis was made. At the end of the seventh week the furosemide was stopped and within 36 hr the abdominal pain, vomiting, and eructation had eased considerably. The serum amylase and lipase began to fall, and a cholecystogram was normal. At the end of the 10th week furosemide was given again in a dose of 40 mg/day and the next day the epigastric pain and eructations returned. The serum amylase and lipase also increased. As before, when the furosemide was discontinued the clinical signs disappeared and the blood values began to return to normal. Thus it is suggested that the diuretic furosemide was responsible for the episodes of acute pancreatitis.

3328 INFLUENCE OF EXOCRINE AND ENDOCRINE PANCREATIC FUNCTION ON INTESTINAL BRUSH BORDER ENZYMATIC ACTIVITIES. *(E.)* Caspary, W. F.; Winckler, K.; Lankisch, P. G.; Creutzfeldt, W. (Dep. Med., Univ. Gottingen, Germany). *Gut* 16(2):89-92, 1975.

Digestive enzymatic activities (disaccaridases, alkaline phosphatase, peptide hydrolases) were studied in small bowel mucosal biopsies from 14 patients with chronic pancreatitis and 10 healthy controls. All chronic pancreatitis patients had abnormal secretin-pancreozymin tests, four had insulin-dependent diabetes mellitus, four had a pathological glucose tolerance test, and nine had steatorrhea. Multiple small bowel biopsies were obtained with a hydraulic biopsy tube under fluorscopic control beyond the ligament of Treitz after an overnight fast. All biopsies showed normal villous structure and light microscopy revealed no signs of mucosal atrophy or inflammation. Maltase, sucrase, and alkaline phosphatase activity was significantly elevated in the chronic pancreatitis patients, whereas lactase, trehalase, and peptide hydrolase activities were normal. Patients with steatorrhea had higher maltase and sucrase activity than those without steatorrhea, while decreased glucose tolerance had no effect on brush border enzymatic activity. It was suggested that decreased exocrine function, rather than decreased endocrine function, was responsible for the increase in intestinal disaccharidase and alkaline phosphatase activity, possibly by the influence of pancreatic enzymes on the turnover of brush border enzymes from the luminal side of the mucosal membrane or by direct hormonal stimulation through cholecystokinin.

3329 CLINICAL AND IMMUNOLOGICAL PARALLELS IN PATIENTS WITH PANCREATITIS AND CHOLECYSTITIS. *(Rus.)* Bordonos, V. G.; Reingardt, B. K.; Maltsev, V. N.; Khramov, A. V. (Kiev Med. Inst., USSR). *Vrach. Delo* (11):74-77, 1974.

Immunological studies were performed on 46 patients with acute and chronic pancreatitis, cholecystopancreatitis, acute cholecystitis and cancer of the pancreas. Autoantibodies to the pancreatic and hepatic tissues were identified by the passive hemagglutination (PHA) and complement fixation (CF) tests. The PHA test was considered positive in titers above 1/8; the CF test varied from weakly positive (+) to strongly positive (+++). The results showed that the highest titer of autoantibodies was observed on the second week after the aggravation of the disease. A correlation was found between the antibody titer and the severity of the disease. The CF test was positive in 22 of the 31 patients; the PHA test in 26 of the 40 patients. A case is reported of a 66-yr-old woman with acute pancreatitis, who on the third day of hospitalization had PHA at 1/32 and CF +++; on the

13th day, PHA 1/512 and CF +++; at the time of the discharge, PHA 1/128, CF +++. Some time later the patient had recurrent pancreatitis. The results indicate that autoantibody tests offer in some cases more reliable criteria to determine the onset of a complete remission. It is suggested that the identification of autoantibodies in the sera of patients with different forms of pancreatitis by PHA and CF tests should be part of clinical examination.

3330 THE EFFECT OF ACTIVE ELASTASE ON THE PANCREATIC TISSUE. *(Rus.)* Chernoiarova, O. D.; Podolskii, A. E. (Sci. Res. Inst. Gastroenterol., Moscow, USSR). *Biull. Eksp. Biol. Med.* 77(11):122-125, 1974.

Histological, histochemical and electron microscope studies of the pancreatic tissue were conducted. Female albino rats weighing 160-180 g were injected with 0.65 or 2.6 mg of elastase into the pancreatic duct; the animals were sacrificed at different intervals. It was found that elastase injection induced acute pancreatitis within 15 min accompanied by the reduction of the amount of proelastase in the tissue and decrease of the inhibitory activity of the serum. One hr after the injection, acute necrotic pancreatitis developed, accompanied by diapedetic hemorrhages into the perivascular space. An increase of the elastase dose to 2.6 mg resulted in the destruction of the elastic membrane of the vein wall. The data obtained suggest an important role played by elastase in the pathogenesis of acute pancreatitis.

3331 ACUTE PANCREATITIS. *(Fr.)* Hay, J. M.; Maillard, J. N. (no affil.). *Cah. Med.* 15(5):231-235, 1974.

3332 ACUTE PANCREATITIS IN RHODESIAN AFRICANS, WITH PARTICULAR REFERENCE TO THE PROBLEMS OF DIAGNOSIS. *(E.)* Wicks, A. C. B.; Fleming, J. B. M. (Harare Cent. Hosp., Rhodesia). *Cent. Afr. J. Med.* 20(6):115-119, 1974.

3333 EXPERIENCE WITH AND RESULTS FROM THE TREATMENT OF ACUTE PANCREATITIS. *(Ger.)* Kothe, W.; Schwokowski, C. F.; Albert, H.; Schauer, K. (Surg. Clin., Karl Marx Univ., Leipzig, Germany). *Zentralbl. Chir.* 99(39):1217-1224, 1974.

3334 GLUCAGON THERAPY OF PANCREATITIS. *(Ger.)* Fleischer, K.; Kasper, H. (Med. Clin., Univ. Wurzburg, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:870-873, 1973.

3335 EARLY DECOMPRESSION OF THE BILIARY TRACT IN ACUTE PANCREATIC NECROSIS. *(Ger.)* Werner, U.; Adler, G. G. (Friedrichshain Munic. Hosp., Berlin, Germany). *Zentralbl. Chir.* 99(39): 1225-1232, 1974.

3336 SILENT ACUTE PANCREATITIS WITH ENCEPHALOMALACIA MIMICKING HEPATIC COMA. *(E.)* Cohen, L.; Sandbank, U.; Rosenfeld, J. B. (Tel Aviv Univ. Med. Sch., Israel). *Am. J. Gastroenterol.* 63(1):75-78, 1975.

3337 DISORDERS IN TRANSIT IN PANCREATITIS AND ACUTE PERITONITIS. *(Fr.)* Vignon, H. (no affil.). *Ann. Anesthesiol. Fr.* 15(Suppl. 1):86-91, 1974.

3338 ESTABLISHMENT OF MODELS FOR ACUTE AND CHRONIC PANCREATITIS. *(Rus.)* Dimenshtein, I. B. (Leningrad Munic. Outpatient Clin. Oncol., USSR). *Patol. Fiziol. Eksp. Ter.* (6):74-78, 1973.

3339 PERITONEAL DIALYSIS AS A POSSIBLE METHOD FOR TREATING ACUTE EXPERIMENTAL PANCREATITIS IN THE RAT. *(Ger.)* Winckler, R.; Lankisch, P. G.; Koop, H.; Schmidt, H. (Med. Clin., Univ. Gottingen, Germany). *Z. Gastroenterol.* 12(Suppl.): 422, 1974.

3340 PATHOGENESIS OF GALLSTONE PANCREATITIS. *(E.)* Thurston, O. G. (Dep. Surg., Univ. Alberta, Edmonton, Canada). *Am. J. Surg.* 129(3):301-303, 1975.

3341 SPONTANEOUS RESOLUTION OF PANCREATIC MASSES (PSEUDOCYSTS?). DEVELOPMENT AND DISAPPEARANCE AFTER ACUTE ALCOHOLIC PANCREATITIS. *(E.)* Czaja, A. J.; Fisher, M.; Marin, G. A. (Philadelphia Gen. Hosp., Pa.). *Arch. Intern. Med.* 135(4):558-562, 1975.

3342 TRANSGASTRIC NEEDLE ASPIRATION OF PANCREATIC PSEUDOCYST THROUGH AN ENDOSCOPE. *(E.)* Rogers, B. H. G.; Cicurel, N. J.; Seed, R. W. (Grant Hosp., Chicago, Ill.). *Gastrointest. Endosc.* 21(3): 133-134, 1975.

3343 THE INDUCTION OF SEGMENTAL PANCREATITIS IN THE RABBIT BY LIGATING THE CAUDAL PART OF THE PANCREATIC DUCT. *(Fr.)* Pietri, H.; Sahel, J. (Paoli-calmettes Inst., Marseille, France). *Biol. Gastroenterol. (Paris)* 7(4):320-321, 1974.

3344 α-AMYLASE ACTIVATION ENERGY AS A FUNCTION OF THE PANCREAS. *(Rus.)* Zabelinskii, E. K. (Leningrad Med. Inst. Sanit. Hyg., USSR). *Lab. Delo* (3):151-152, 1975.

3345 ISOENZYMES OF α-AMYLASE IN THE DUODENAL JUICE OF PATIENTS WITH PATHOLOGICAL PANCREAS AND ASSOCIATED ORGANS. *(Rus.)* Dykul', N. M. (Inst. Cytol. Genet., Novosibirsk, USSR). *Lab. Delo* (3):155-157, 1975.

3346 ENZYME SUBSTITUTION IN IMPAIRED DIGESTION. *(Ger.)* Beck, K. (German Diagn. Clin., Wiesbaden). *Z. Gastroenterol.* 13(Suppl.):171-188, 1975.

See also, 2574, 2861, 2872, 2876, 2882, 2907, 2909, 2910, 2912, 2961, 2962, 2966, 2967, 3106, 3111, 3280, 3312, 3604.

LIVER AND BILIARY TRACT

3347 INTRAHEPATIC ARTERIOVENOUS FISTULA RESULTING FROM NEEDLE BIOPSY: A CASE REPORT. *(E.)* Okuda, K.; Kotoda, K.; Igarashi, M.; Karasawa, E. (Chiba Univ. Sch. Med., Japan). *Acta Hepatogastroenterol. (Stuttg.)* 21(6):422-425, 1974.

A case report is presented in which an intrahepatic arteriovenous fistula developed in a 36-yr-old male alcoholic who had undergone needle biopsy approximately one month previously. On admission, coagulation studies were normal although several liver function tests, including total and direct bilirubin (1.7 and 1.0 mg%, resp.) were abnormal. The patient had radiologic evidence of cardioesophageal varices. Percutaneous needle biopsy of the liver was performed without incident. The specimen contained a small portion of parenchyma and a long segment of fibrous portal tract with some vessel wall tissue. Celiac angiography performed 4 weeks later revealed simultaneous opacification of a branch of the right hepatic artery and several portal vein branches. The contrast medium in the portal branches persisted for a few sec after disappearance of the arterial opacification. No bruit was audible over this area. The defect was seen in the same area in which the biopsy had been performed. The patient improved, was discharged after two months and has remained unchanged on follow-up examination. It is concluded that a post-biopsy hepatic arteriovenous fistula should be considered in anyone who manifests increased portal hypertension or from whom a large piece of portal tissue is obtained.

3348 DISCRIMINATIVE AND PROGNOSTIC SIGNS IN ACUTE HEPATIC COMA, TREATED BY EXCHANGE TRANSFUSIONS. *(E.)* Demedts, M.; De Groote, J.; Vandamme, B.; Desmet, V. J. (St. Rafael Acad. Hosp., Louvain, Belgium). *Digestion* 11(1/2):105-114, 1974.

Factors affecting prognosis were evaluated in 14 consecutive cases of hepatic coma. All patients were in coma, apparently due to acute viral hepatitis, for 6-36 hr prior to initiating treatment. This included multiple exchange transfusions with 3-7 liters fresh whole blood, prednisone (25-250 mg/day), correction of electrolyte imbalance, hydration, and other supportive therapy. Clinically, no distinction could be made between the encephalopathy exhibited by the 5 survivors and the 9 who died. Patients whose outcome was ultimately favorable responded with improved consciousness after 2-4 transfusions (3 days) and generally became fully alert within 6 days. Several, however, developed transient complications which included significant ascites (2), bleeding stress ulcers (2), and septicemia (1). Patients who eventually died showed a progressively deteriorating course with no response to transfusion. No patients who presented with severe dysrhythmias on EEG survived. Prior to exchange transfusion, patients who eventually died had higher mean arterial ammonia levels (0.28 mg% *versus* 0.16 mg%) and more prolonged prothrombin times (< 15% of control *versus* 5-50%) than did those who survived. Liver biopsy specimens from patients who died showed more extensive necrosis with interlobular confluence than did those from surviving patients. Biopsies taken up to 7 yr later from patients who survived showed no evidence of cirrhosis. It is thus concluded that assessment of EEG changes, arterial ammonia levels, prothrombin times and liver histology may be of prognostic value in patients with hepatic coma.

3349 BILE ACID KINETICS IN RELATION TO SEX, SERUM LIPIDS, BODY WEIGHTS, AND GALLBLADDER DISEASE IN PATIENTS WITH VARIOUS TYPES OF HYPERLIPOPROTEINEMIA. *(E.)* Hellstrom, K.; Kallner, M. (Serafim Hosp., Stockholm, Sweden). *J. Clin. Invest.* 54(6):1301-1311, 1974.

Fifteen normolipidemic and 61 hyperlipidemic subject/patients (35-67 yr, 23 with various gallbladder diseases and the rest with nongastrointestinal diseases or normal) were maintained on a standardized diet of the natural type for 4-7 days. Caloric intake was adjusted to keep the body weight constant. [^{14}C]Cholic acid (4 μCi) and [^{3}H]chenodeoxycholic acid (15 μCi), as sodium salts were dissolved in water and taken p.o. before breakfast. Four samples of duodenal bile were collected from each at 2-4 day intervals. Cholecystokinin was given i.v. and 5-10 ml concentrated duodenal bile obtained through a thin tube. The specific radioactivities of cholic acid and chenodeoxycholic acid were determined in each sample. Venous blood samples were drawn 4-6 times and analyzed for cholesterol, triglyceride, and lipoprotein pattern. The total bile acid formation was within normal limits in patients with hyperlipoproteinemia types IIa and IIb. The average production

of cholic acid represented less than 50% of the total bile acid synthesis in both groups. The corresponding value for the controls was 64%. The synthesis of cholic acid in hyperlipoproteinemia type IIa was significantly below normal. Of the 27 patients with the type IV pattern, 18 had a synthesis of cholic acid and cholic acid + chenodeoxycholic acid that exceeded the upper range recorded for the controls. In these subjects the cholic acid formation represented 73% of the total bile acid synthesis. Similar findings were also encountered in 5 patients with the type V lipoprotein pattern. The bile acid pool size of the 11 patients with hyperlipoproteinemia type IV, who had been cholecystectomized or suffered from cholelithiasis, was 900 mg smaller than that of the other subjects with the same type of hyperlipoproteinemia. The pool size of the former subjects, however, still tended to be higher than that of the controls. In all groups, the formation of bile acids tended to be higher in males than in females. Bile acid synthesis showed no linear correlation to actual body weight, relative body weight, or body surface area. A moderate weight reduction in 5 patients was followed by a 50% reduction of the cholic acid and chenodeoxycholic acid synthesis. It is suggested that the abnormal low density lipoprotein metabolism in hyperlipoproteinemia type II is closely linked to abnormal bile acid kinetics which may or may not be the more fundamental defect. The mechanisms responsible for the accumulation of very low density lipoprotein in hyperlipoproteinemia type IV have not been established. The large bile acid pool size and the tendency to elevated fractional bile acid turnover in this disorder suggest a defect at the intestinal level.

3350 DISPOSABLE ORGAN CHAMBER FOR PERFUSION OF THE EX VIVO LIVER AND ITS USE IN THE TREATMENT OF HEPATIC COMA. *(E.)* Hanson, C.; Baker, P. R.; Cuschieri, A. (Dep. Surg., Univ. Liverpool, England). *Eur. Surg. Res.* 6(1):41-45, 1974.

Two female patients, one 50 yr old and the other 20, in hepatic coma were treated by extracorporeal hepatic assist using a plastic disposable organ chamber for the perfusion of the *ex vivo* liver. The organ chamber consisted of a 12-inch diameter plastic salad container and a 5.5-inch diameter plastic funnel. The liver was held in a 10-inch plastic colender and the entire chamber covered with a clear plastic lid. The entire organ chamber was siliconized prior to sterilization using acid glutaraldehyde. Using this organ chamber, hepatic assist of 3.5 hr duration was performed on the 50-yr-old patient when in stage IV coma. Blood ammonia was 300 µg/100 ml; total serum bilirubin was 4.3 mg/100 ml. A liver from an 18 kg pig was used, the circuit being primed with fresh human blood of the same blood group as the patient's. The estimated blood flow through the liver was low for the first 30 min, but thereafter averaged 300 ml/min. The patient recovered full consciousness within 18 hr of the assist, and her blood ammonia dropped to 64 µg/100 ml. She died of bronchopneumonia 14 days after the assist. The bronchopneumonia was believed not to be due to the porcine liver perfusion because the infection did not develop until 10 days later. It is suggested that the improvement in cardiac and renal function after assist in this patient may be due to removal of toxic metabolites by the porcine liver. The second patient, who was in an advanced degree of cirrhosis, was given hepatic assist for 3 hr eight days after a colonic by-pass operation. The same technique was used as for the first patient. The average liver blood flow during perfusion was 300 ml/min. The patient regained partial consciousness the following day and was fully conscious on the 4th day after the assist. Her blood ammonia decreased from a pre-assist level of 210 to 55 µg/100 ml 48 hr after perfusion. Severe jaundice continued, however, and serum bilirubin went to 30 mg/100 ml. Renal failure developed 12 days after the assist and she died on the 20th day. Although the patients died, the assist was considered successful because the patients regained consciousness shortly after the procedure. According to the authors this disposable organ chamber has several advantages: 1) venous outflow from the perfused liver is unimpeded and can be measured to provide an immediate assessment of the efficiency of the perfusion; 2) the colender provides greater maneuverability of the liver within liver chamber; and 3) connection of the cannulae is a quick and easy process.

3351 ERYTHROCYTOSIS IN HEPATOCELLULAR CARCINOMA: A COMPENSATORY PHENOMENON. *(E.)* Tso, S. C.; Hua, A. S. P. (Dep. Med., Univ. Hong Kong, Queen Mary Hosp.). *Br. J. Haematol.* 28(4):497-503, 1974.

Nine patients with erythrocytosis complicating hepatocellular carcinoma were studied to determine whether erythropoetin or its precursor was autonomously produced by the tumor. At least two plasma samples and three consecutive 24-hr urine samples were collected prior to phlebotomy, and more samples were taken for 3 days after phlebotomy. Plasma was assayed for erythropoetin with hypertransfused plethoric mice and the pH, volume, and creatinine concentration of the urine were determined. For comparison, plasma samples were collected from three polycythemia vera patients before and after phlebotomy. Plasma and urine samples were also collected from two normal subjects and three with gastrointestinal bleeding. Plasma erythropoetin levels rose following phlebotomy in seven patients, in three of which the rise was significant. In contrast, no rise was seen in the polycythemia vera patients. None of the carcinoma patients showed a significant rise in urinary erythropoetin output after phlebotomy. The gastrointestinal patients showed a fluctuating but definite elevation of erythropoetin activity in both plasma and urine. It is suggested that the increased erythropoetin levels and resultant erythrocytosis are compensatory in nature rather than autonomous.

3352 HEMOCHROMATOSIS: PATHOPHYSIOLOGIC AND GENETIC CONSIDERATIONS. *(E.)* Ross, C. E.; Muir, W. A.; Ng, A. B. P.; Graham, Jr., R. C.; Kellermeyer, R. W. (Univ. Hosp. Cleveland, Ohio). *Am. J. Clin. Pathol.* 63(2):179-191, 1975.

Two families with idiopathic hemocromatosis were studied with respect to the mechanisms of pathogenesis and genetics. In addition to routine hematologic studies, erythrocyte incorporation and uptake studies were performed with ^{59}Fe, and biopsies of bone marrow and liver were stained with hematoxylin and eosin, trichrome, and prussian blue. Electron microscopic studies were also done. In one family only the proband and an older sister showed any evidence of hemochromatosis. The sister died at the age of 23 from the disease, and the proband at the age of 16 showed unmistakable pathological changes. Findings in both included normal or slightly altered liver architecture with some portal fibrosis. There was marked deposition of iron in the hepatic cells, but little or none in the Kupffer cells. In the older sister, cirrhosis was evident, and iron was found in the pancreas in moderate amounts, but only trace amounts were found in the spleen. Bone marrow iron was normal or decreased. In the second family, seven members showed evidence of hemochromatosis. The ages of those with high hepatic cell iron ranged from 27 to 52. Findings included mild portal and interlobular fibrosis, concentration of iron in the hepatic cells, and only trace amounts in the Kupffer cells. The autopsies of the four iron overload cases, in contrast, showed high concentrations of iron in the Kupffer cells with smaller amounts in the hepatic cells, and the splenic and marrow iron was equal to or greater than the hepatic iron. These observations support the view that there are two distinct forms of the disease: a severe autosomal recessive form; and a milder autosomal dominant form with a later onset. It is concluded that both types may be due to a similar defect in the reticulo-endothelial system that places an increased burden on the liver parenchyma cells.

3353 WILSON'S DISEASE. CLINICAL AND LABORATORY MANIFESTATIONS IN 40 PATIENTS. *(E.)* Strickland, C. G. T.; Leu, M.-L. (Nav. Med. Res. Inst., Bethesda, Md.). *Medicine* 54(2):113-138, 1975.

The clinical and laboratory manifestations of Wilson's disease in 40 patients are reviewed. The 16 males had an earlier mean age at onset (12.2 yr) than did the 24 females (22.1 yr). The average age of the 18 patients who died was 19.1 yr. General symptoms and signs included Kayser-Fleischer rings (37), splenomegaly (21), hyperpigmentation of the legs (20), bleeding and easy bruising (17), edema (12), arthralgias (11) and jaundice (11). Four patients had severe liver failure. Commonly seen neurologic manifestations included poor coordination (28), psychological impairment (27), tremor (26), dysarthria (26), abnormal gait (25), rigidity (24), dementia (23), dystonia (23), drooling (22), choreoathetosis (12) and coma (12). All 40 patients had reduced ceruloplasmin (mean = 0.050 Ravin U). Serum copper was reduced (47 µg%) in all and urinary copper was elevated (344 µg/day) in 33 of the 34 patients tested. Pancytopenia was frequently found and was correlated with splenomegaly. Serum uric acid was decreased (2.5 mg%) in 25 of 32 while uric acid clearancewas increased (1.7 ml/min/1.73m^2) in 21 of 24. Creatinine clearance was reduced in 7 of 24 while cadmium clearance was slightly increased in 4 of 21 and phosphate clearance was markedly elevated in 8 of 22. Hyperaminoaciduria occurred in most patients who had recieved less than one yr of penicillamine treatment. Prothrombin time was the most commonly abnormal liver function test, prlonged in 26 of 33. Total serum proteins were reduced (≤ 6 mg%) in 9 of 31. Proteinuria was present in 13 of 38, three of whom also had hematuria. The varied manifestations of Wilson's disease are stressed; because of the genetic heterogeneity, it is cautioned that manifestations in different patients, from different families, and of different races may have minor variations

3354 COAGULATION FACTOR CONCENTRATE IN THE TREATMENT OF THE HAEMORRHAGIC DIATHESIS OF FULMINANT HEPATIC FAILURE. *(E.)* Gazzard, B. G.; Lewis, M. L.; Ash, G.; Rizza, C. R.; Bidwell, E.; Williams, R. (King's Coll. Hosp., London). *Gut* 15(12):993-998, 1974.

Nine patients in fulminant hepatic failure were studied for their response to prophylactic infusion of a coagulation factor concentrate containing factors IX, X, II and a small amount of VII with or without heparin. All patients had prothrombin time ratios ≥ 2.2 on admission. Of five patients receiving factor concentrate without heparin, three developed fatal hematemesis and melena within 48 hr of initiation of therapy. All five died, four within one week and the last after 14 days. Extensive hepatic necrosis with gastrointestinal hemorrhage was the major necropsy finding in four. Of the four patients treated with coagulation factor concentrate plus heparin, only one had minor gastrointestinal bleeding. One patient survived and three died of respiratory complications. Coagulation and hematologic profiles did not deteriorate as markedly in the group receiving heparin supplemental therapy. In both groups, clotting factor assays showed increased factor II levels, small changes in factor IX and X levels and uniformly low factor V levels. Factor VIII levels dropped rapidly in patients receiving factor therapy without heparin but did not change appreciably in patients receiving heparin. It is thus concluded that factor IX concentrate cannot presently be recommended in the treatment of bleeding diathesis associated with hepatic failure because of its inability to correct factor deficiency and its possible aggravation of intravascular coagulation.

3355 SHORT-CHAIN ORGANIC ACIDEMIA AND REYE'S SYNDROME. *(E.)* Trauner, D. A.; Nyhan, W. L.; Sweetman, L. (Univ. Calif. San Diego, La Jolla). *Neurology (Minneap.)* 25(3):296-298, 1975.

Short-chain fatty acid levels were determined using gas-liquid chromatography prior to initiation of therapy in seven patients with Reye's syndrome. Blood samples taken within 24-48 hr after the onset of symptoms showed 3-20-fold elevations in propionate, butyrate and isobutyrate compared to control subjects with no known liver disease. No consistent correlation was found between the concentration of any of the short-chain fatty acids and the eventual clinical outcome. These findings are consistent with previous reports showing elevated total free fatty

acids in patients with Reye's syndrome and suggest that certain short-chain fatty acids may play a role in the clinical manifestations of the syndrome.

3356 FASTING SERUM BILE ACID LEVELS IN THE PRIMARY HYPERLIPOPROTEINEMIAS. *(E.)* Korman, M. G.; Ellefson, R. D.; Hofmann, A. F. (Mayo Grad. Sch. Med., Rochester, Minn.). *Mayo Clin. Proc.* 50 (2):76-78, 1975.

Fasting serum levels of cholic acid conjugates were measured in 126 males and 107 females with various types of hyperlipoproteinemia by radioimmunoassay. Subjects with type IIa hyperlipoproteinemia had significantly lower levels of cholic acid conjugates (0.10 μM) than did 80 healthy controls (0.50 μM). Patients with type IIb, III, IV and V hyperlipoproteinemia had values similar to those of the control group. The abnormally low fasting value of cholic acid conjugates in type IIa patients is considered to reflect decreased secretion of bile acid into the intestine in such patients, who are known to have defective bile acid synthesis rates and decreased bile acid pool sizes.

3357 COMPARISON OF THE EFFECTS OF TOTAL PARENTERAL NUTRITION, CONTINUOUS INTRAGASTRIC FEEDING, AND PORTACAVAL SHUNT ON A PATIENT WITH TYPE I GLYCOGEN STORAGE DISEASE. *(E.)* Burr, I. M.; O'Neill, J. A.; Karzon, D. T.; Howard, L. J.; Greene, H. L. (Vanderbilt Univ. Sch. Med., Nashville, Tenn.). *J. Pediatr.* 85(6):792-795, 1974.

Clinical status, blood chemistry and platelet function were assessed in a 16-yr-old male with type I glycogen storage disease who was treated with parenteral nutrition, continuous intragastric feeding and portacaval shunt. At the time therapy was initiated the patient had marked hepatomegaly, multiple bruises, fasting hypoglycemia, elevated serum lipids, uric acid and lactic acid, a reduced response to glucagon stimulation, decreased glucose-6-phosphatase activity in a liver biopsy specimen, and abnormal platelet function. Treatment by parenteral nutrition for 21 days resulted in transiently decreased liver size, a return of blood chemistry values toward normal, and normalization of ADP-mediated platelet aggregation. Retreatment six weeks later by continuous intragastric feeding again produced marked improvement in the biochemical profile and in platelet function and a decrease in liver size. On the 23rd day of intragastric feeding, the patient underwent an end-to-side portacaval shunt. Although post-operative uric acid levels and platelet function returned to pretreatment values and hypoglycemic symptoms returned with strenuous exercise and fasting beyond 6 hr, the patient experienced no significant bleeding episodes and grew 4 inches in 5 months. These results indicate that continuous nutrition *per se* will revert the anomalies associated with type I glycogen storage disease and are in agreement with those of previous studies.

3358 CHOLESTASIS IN IMMATURE NEWBORN INFANTS: IS PARENTERAL ALIMENTATION RESPONSIBLE? *(E.)* Rager, R.; Finegold, M. J. (Bellevue-New York Univ. Med. Cent. N.Y.). *J. Pediatr.* 86(2):264-269, 1975.

The effect of parenteral alimentation on the development of intrahepatic cholestasis was investigated retrospectively in nine of 15 premature infants (≤ 30 week gestation, birth weight 1250 g) who survived at least 5 days. The nine, who were shown at autopsy to have cholestasis, were compared with the remaining six who did not have cholestasis. All 15 babies who also had respiratory distress, hemorrhage or infection, were maintained by total i.v. hyperalimentation (90 cal/kg in 150 mg/day). Only three of the nine cholestatic patients received some oral nutrition during the first 10 days whereas four of the six noncholestatic patients were successfully fed p.o. during the initial week. None of the affected patients was able to sustain oral or nasogastric feeding during the first 17 days. The fact that cholestasis was seen in one patient fed p.o. except for the last 3 days of life and that cholestasis did not develop in one patient maintained for 20 days on hyperalimentation after 10 days of oral feeding suggested no correlation between the hyperalimentation and cholestasis. Increasing survival did not result in progressive liver disease. It is concluded that early fasting rather than parenteral supplementation may contribute to the development of cholestasis in the small premature infant.

3359 ALPHA-1-ANTITRYPSIN IN DUODENAL FLUID AND GALLBLADDER BILE. *(E.)* Kyaw-Myint, T. O.; Howell, A. M.; Murphy, G. M.; Anderson, C. M. (Inst. Child Health, Univ. Birmingham, England). *Clin. Chim. Acta* 59(1):51-54, 1975.

α_1-Antitrypsin concentrations were determined by electroimmunoassay in duodenal fluid from 16 patients aged 7 days to 7 yr being investigated for various gastroenterological problems. In addition, gallbladder bile obtained from five patients post mortem and from one patient at laparotomy was investigated. α_1-Antitrypsin (5.6-32.0 mg%) was detected in 20 of 26 fasting and pancreozymin-stimulated duodenal samples from 13 patients. Concentrations were significantly lower in children with liver disease than in those with extrahepatic diseases. All samples had some degree of trypsin inhibitory capacity which did not correlate with the α_1-antitrypsin concentration. α_1-Antitrypsin (8-40 mg%) was also detected in all bile samples except one from a patient with complete extrahepatic obstruction. Thus, unlike its activity in human serum, α_1-antitrypsin makes only a small contribution to the trypsin inhibitory activity of duodenal contents. The results are consistent with a model in which α_1-antitrypsin is delivered from the liver to the small intestine *via* the bile.

3360 HEPATIC DUCTULAR HYPOPLASIA ASSOCIATED WITH CHARACTERISTIC FACIES, VETEBRAL MAL-

FORMATIONS, RETARDED PHYSICAL, MENTAL, AND SEXUAL DEVELOPMENT, AND CARDIAC MURMUR. *(E.)* Alagille, D.; Odievre, M.; Gautier, M.; Dommergues, J. P. (INSERM, Parrot Hosp., Bicetre, France). *J. Pediatr.* 86(1): 63-71, 1975.

The clinical, biologic and histologic features of a group of 15 patients aged 1-21 yr with hepatic ductular hypoplasia and normal extrahepatic bile ducts are presented. These patients were selected from a larger group of 30 with ductular hypoplasia seen over a 18-yr period. The earliest manifestation of the disease, which is equally prevalent in males and females, was persistent cholestasis seen during the first 3 months of life. Moderate elevations in serum bilirubin concentration were associated with intense pruritus and hepatosplenomegaly even in the absence of portal hypertension. Later in the course of the disease, serum lipids and cholesterol rose to extremely high values and alkaline phosphatase increased 3- to 5-fold. Histologically, bile ducts were absent from most portal triads and mild periportal fibrosis was sometimes present. Other characteristics of the syndrome included: 1) characteristic faces with a prominent forehead, deeply set eyes, a straight nose and a small, pointed chin seen in all 15 patients; 2) a harsh midsystolic murmur over the pulmonic area heard in 12; 3) vertebral arch defects demonstrated in eight; 4) growth retardation in eight; 5) mental retardation (IQ = 60-80) in nine; and 6) hypogonadism in six males, five of whom had high circulating plasma testosterone levels. Family histories positive for neonatal cholestasis among siblings were obtained in three cases. Only two patients died, each without liver failure, and follow-up data indicate that this condition carries a better prognosis than do other types of intrahepatic cholestasis.

3361 THE EFFECT OF LIVER DISEASE IN MAN ON THE DISPOSITION OF PHENOBARBITAL. *(E.)* Alvin, J.; McHorse, T.; Hoyumpa, A.; Bush, M. T.; Schenker, S. (Vanderbilt Univ. Sch. Med., Nashville, Tenn.). *J. Pharmacol. Exp. Ther.* 192(1):224-235, 1975.

The disposition of phenobarbital was studied in eight normal individuals and in nine patients with cirrhosis and eight patients with acute viral hepatitis. Diagnoses were established by appropriate laboratory and pathologic studies. All subjects had normal renal function and were free of alchohol or other drug ingestion for at least 3 weeks. Following a 12-hr fast, ^{14}C-phenobarbital (0.85 mg/kg, 50 μCi) was administered by duodenal intubation. ^{14}C-Labeled phenobarbital and its principal metabolites, *p*-hydroxyphenobarbital (PBOH) and conjugated *p*-hydroxyphenobarbital (PBOC), were identified and quantitated by chromatographic methods in blood and urine for 5 days. Phenobarbital blood half-life in the control group was prolonged to 130 hr ($P < .05$). No PBOH and only traces of PBOC were detected in the blood of either control individuals or patients with liver disease. Urinary excretion of unchanged phenobarbital was an important elimination pathway of the drug in all groups. As a result of this, phenobarbital blood half-life in cirrhosis was only moderately prolonged. Thus, phenobarbital may be a reasonable choice as a sedative in cirrhosis patients.

3362 EARLY DIAGNOSIS OF LIVER METASTASES: AN EVALUATION OF THE INDIVIDUAL DIAGNOSTIC PROCEDURES. *(Ger.)* Sabitzer, H.; Deimer, E.; Hohenberg, G.; Wickenhauser, J. (Radiother. Inst., Univ. Vienna, Austria). *Wien. Klin. Wochenschr.* 86(19): 573-577, 1974.

Different diagnostic procedures in the early diagnosis of liver metastases are evaluated on the basis of 406 cases in which different diagnostic techniques and their combinations were applied, and a step-by-step diagnostic procedure is proposed. Liver function tests and scintigraphic tests are performed first, after which ultrasonic technique is applied in suspect and positive cases. Biopsy is indicated in suspect diffuse hepatic alterations. Laparoscopy and angiography are recommended if nodular alterations are suspected. Angiography is a method of choice especially in the case of hypervascularized tumors. Liver enzyme and scintigraphic tests suggested metastases in 69 cases. Alkaline phosphatase, leucin arylamidase, and γ-glutamyl transpeptidase tests were found to be the most relevant of all enzyme tests for the diagnosis of liver metastases. The enzyme test results were correct in 68.1% of the 69 cases, and wrong in 17.4%. The scintigraphic findings were correct in 62.3% of the 69 cases, and false-positive or negative in 30%. The ultrasonic test results were correct in 71%, and false-positive or negative in 21%. Arteriography, performed in nine patients, gave correctly positive results in three cases, four correctly negative results in four cases, and one false-positive and negative result in one case each. Metastases were ruled out by laparoscopy correctly in six of nine cases, and confirmed in two cases, while metastases were found in one patient with negative laparoscopic findings at a follow-up after 3 months. All findings from all diagnostic tests were consistent in 16 cases.

3363 BILE ACIDS AND BILE ACID SULFATES IN THE SKIN OF PATIENTS WITH CHOLESTASIS AND PRURITUS. *(Ger.)* Stiehl, A. (Med. Clin., Univ. Heidelberg, Germany). *Z. Gastroenterol.* 12(2):121-124, 1974.

Sulfated and nonsulfated bile acids were extracted from the serum, urine, and skin of seven patients with cholestasis and pruritus and of five controls with cholestasis but not pruritus. Bile acids were fractionated on Sephadex LH-20, taurine and glycine conjugates were hydrolyzed enzymatically, and sulfate esters were subjected to solvolysis before quantitative analysis with gas chromatography. No significant difference was found between total serum or urinary bile acids in patients with cholestasis and pruritus and in those with cholestasis alone. However, bile acids were significantly increased in the skin of patients with cholestasis and pruritus. The content of sulfate esters of bile acids was low in the skin of both groups. In patients with cholestasis and pruritus, cholic acid was present in

the highest concentration in the serum, while chenodeoxycholic acid was found in the highest concentration in the skin. In two of five controls, urinary bile acid excretion was increased to 150 mg/24 hr. Since both serum and skin bile acid contents were significantly lower than in patients with cholestasis and pruritus, it is suggested that the large amounts of bile acids excreted in the urine of these patients prevented pruritus from developing.

3364 LAPAROSCOPIC FINDINGS IN ERYTHROPOIETIC PROTOPORPHYRIA. *(Ger.)* Solis-Herruzo, J. A.; Perez-Pena, F. (Med. Clin., Univ. Madrid, Spain). *Z. Gastroenterol.* 12(5):335-340, 1974.

A 25-yr-old man was diagnosed as having erythropoietic protoporphyria on the basis of characteristic skin lesions; deposits of PAS-positive, amylase-resistant hyaline material in the perivascular region of the skin; transitory red fluorescence of RBC in the peripheral blood and a bone marrow biopsy; a positive Rimmington and Cripps fluorescence test in the blood; and normal urinary excretion of prophobilinogen, coproporphyrin, and uroporphyrin. At laparoscopy the entire surface of the liver appeared to be uniformly covered with small granules as in nodular cirrhosis. The parenchyma was bluish-gray in color, similar to that in patients with Dubin-Johnson syndrome, but this diagnosis was ruled out by cirrhosis, the distribution of pigment in the liver, and histochemical analysis of the pigment. No green color suggestive of intrahepatic cholestasis was present. Examination of a liver biopsy showed dilatation of the portal fields with fibrous septa and regenerative nodules. Hepatocytic degeneration and necrosis were evident, and many liver cells contained small quantities of bilirubin. Reddish-brown islets of pigment appeared in the intercellular space, hepatocytes, and bile ducts where they formed thrombi. This pigment showed red fluorescence under UV light. Samples of lyophilized liver contained large quantities of protoporphyrin (573 μg/g) along with coproporphyrin (28 μg/g) and other porphyrins (20 μg/g).

3365 SULFATED AND NONSULFATED BILE ACIDS IN URINE, SERUM, AND BILE OF PATIENTS WITH HEPATOBILIARY DISEASES. *(E.)* Makino, I.; Hashimoto, H.; Shinozaki, K.; Yoshino, K.; Nakagava, S. (Hokkaido Univ. Sch. Med., Sapporo, Japan). *Gastroenterology* 68(3):545-553, 1975.

The concentrations of sulfated and nonsulfated bile acids in the serum, urine, and bile were studied in patients with hepatobiliary diseases and normal subjects. Large amounts of bile acid sulfate were found in the urine of the hepatobiliary disease patients. In patients with acute hepatitis, the daily urinary excretion of bile acid was 68.24 μM/day and the percentage of sulfated bile acid was 83.4%. In patients with chronic hepatitis and cirrhosis, a slight increase in urinary bile acid over normal values was observed (2.89 and 5.27 μM/day, resp.) and the percentage of bile acid was 73.9% and 30.4%, resp. In patients with obstructive jaundice, urinary bile acid was moderately increased (32.62 μM/day) and the percentage of sulfated bile acid was 58.3%. In the hepatobiliary disease patients, the levels of both sulfated and nonsulfated bile acids in the serum were elevated over normal levels. The percentage of sulfated bile acid in normal serum was 9%, and it varied from 0-8218% in the pathological sera. Sulfated bile acid was markedly increased in the sera of patients with obstructive jaundice and acute hepatitis, while chronic hepatitis and cirrhosis were associated with a moderate increase. Large amounts of nonsulfated bile acid were found in all bile acids, but sulfated bile acid appeared only in very small amounts (below 0.5%). The findings suggest that the increased bile acid in the serum of patients with hepatobiliary disease might be more easily excreted in the urine as sulfated bile acid. The results provide no indication of a differential diagnostic significance of sulfated bile acid in various hepatobiliary diseases.

3366 LIVER INCLUSIONS IN ERYTHROPOIETIC PROTOPORPHYRIA. *(E.)* Wolff, K.; Wolff-Schreiner, E.; Gschnait, F. (Dep. Dermatol. I, Univ. Vienna, Austria). *Eur. J. Clin. Invest.* 5(1):21-26, 1975.

Liver histology was studied in two patients, a 21-yr-old man and a 36-yr-old woman, with erythropoietic protoporphyria. Both patients had markedly elevated protoporphyrins, considerable fluorescence and photohemolysis of RBC, but no porphyrinuria. Liver biopsy specimans from both patients obtained on two separate occasions each showed moderate fatty changes, portal inflammation and incipient fibrosis, and occasional focal cell necrosis. The cytoplasm of both hepatocytes and Kuppfer cells contained brown pigment granules which were birefingent and highly fluorescent. On electron microscopy, these granules were composed of straight or slightly curved needle or rod-like crystals 0.04-0.5 mμ long and 70-130 Å wide. The crystals were free in the cytoplasm or were ocassionally within autophagosomes of hepatocytes and were within membrane-delimited phagosomes of Kuppfer cells. The specimens from one patient also exhibited non-membrane-bound paracrystalline bodies within the cytoplasm of hepatocytes and occasionally within extracellular spaces. Needle-like granules such as those seen in the livers of both of these patients have not been reported in patients with porphyria cutanea tarda or other hepatic diseases; thus they may be characteristic for protoporphyric liver disease. The paracrystalline bodies seen in the second patient are, on the other hand, identical to the paracrystalline bodies which have been reported in rare individuals with Wilson's disease, porphyria cutanea tarda, and other liver conditions. These bodies may reflect, in a nonspecific way, a disturbance of hepatocyte function.

3367 BIOCHEMICAL FEATURES OF LIVER LESIONS IN PATIENTS WITH COLLAGEN DISEASES. *(Rus.)* Pankina, V. Kh. (Inst. Rheum., Moscow, USSR). *Klin. Med. (Mosk.)* 52(7):56-60, 1974.

Studies were made of hepatospecific serum enzymes in 110 collagen patients (59 with rheumatism, 25 with lupus erythematosis, 26 with scleroderma and 25 healthy people). The results showed that all the patients had significant changes in the activity of the enzyme specific for liver pathology. In patients with rheumatism, the activities of histidase and urocanase averaged 1.9 and 3 μM, resp. It is indicated that enlargement of the liver was observed in five of the 44 adult patients, while organospecific enzymes were recorded in 22 cases. In 15 children with rheumatism, the activity of histidase and urocanase prior to chemotherapy was 2.8 and 3.2 μM. After the treatment the enzyme activity returned to normal. In the adults, histidase decreased from 1.6 to 1.1 M, while urocanase activity did not change. Histidase and urocanase activity was elevated in 80% of the lupus erythematosis patients to 2.5 and 4.5 μM, resp. Correlation was observed between enzyme activity and severity of the disease. Liver pathology was found in 80% of the scleroderma patients (histidase 3.0 μM; urocanase 2.3 μM). It is concluded that enzyme activity is indicative of liver pathology in collagen patients with no clinical signs. It is suggested that liver pathology may not be the result of the use of chemotherapeutic agents.

3368 METASTATIC CARCINOMATOSIS OF THE LIVER MIMICKING CIRRHOSIS: CASE REPORT AND REVIEW OF THE LITERATURE. *(E.)* Borja, E. R.; Hori, J. M.; Pugh, R. P. (Cancer Res. Cent., Columbia, Mo.). *Cancer* 35(2):445-449, 1975.

The case of a 46-yr-old woman with breast carcinoma presenting with ascites, jaundice, spider angiomas, and portal hypertension is reported. On hepatic scan, the liver appeared to be almost the same size as the spleen, a finding frequently seen in cirrhosis. A program of treatment with 5-fluorouracil, cyclophosphamide, prednisone, methotrexate, and triiodothyronine was initiated; furosemide was also given for the ascites. The program was of no benefit and the patient died a few days later from uncontrolled esophageal bleeding. Microscopic examination of the liver at autopsy disclosed metastatic, poorly differentiated adenocarcinoma, similar in pattern to that in a breast biopsy sample. Intense stromal fibrosis and intravascular tumor infiltration with compression of the blood vessels, mainly of the portal system, was also seen. In addition, there was microscopic evidence of tumor invasion of the left breast, right axillary nodes, lungs, adrenal glands, and bone marrow. Five other cases resembling cirrhosis due to breast carcinoma are reported in the literature. The clinical pictures in all 6 cases were similar, with uncontrolled esophageal bleeding being the terminal event in each instance. In 5 of the 6 cases, the liver was larger than normal, and the characteristic histologic feature was the intense, diffuse fibrosis of the liver parenchyma. Type IV mammary carcinoma characterized by widespread metastases and a rapidly fatal course was seen in all cases. Although aggressive therapy directed against the malignant process might alter the course of this invariably fatal complication, there seems little indication for aggressive surgical management of the resulting portal hypertension.

3369 LIVER DISEASE IN RHEUMATOID ARTHRITIS AND SJØGREN'S SYNDROME. *(E.)* Webb, J.; Whaley, K.; MacSween, R. N. M. Nuki, G.; Dick, W. C.; Buchanan, W. W. (R. Infirm., Glasgow, Scotland). *Ann. Rheum. Dis.* 34(1):70-81, 1975.

The frequency of 2 serological markers of hepatic disease, mitochondrial antibody and smooth muscle antibody, and the frequency of abnormal laboratory tests of hepatic function were prospectively evaluated in 216 patients with rheumatoid arthritis, 32 patients with Sjogren's syndrome, 27 patients with the sicca syndrome, and 289 patients with osteoarthrosis or a form of seronegative polyarthropathy. The highest frequencies of raised serum alkaline phosphatase levels and abnormal BSP excretion tests were found in the Sjogren's syndrome, rheumatoid arthritis, and sicca syndrome patients; most of the mitochondrial antibody, salivary duct antibody-, and smooth muscle antibody-positive patients were also within these disease groups. Among the patients with Sjogren's syndrome, rheumatoid arthritis, and the sicca syndrome, the prevalence of raised serum alkaline phosphatase and glutamic oxaloacetic transaminase levels, abnormal BSP excretion tests, hepatomegaly, and splenomegaly was significantly greater in those who were positive for mitochondrial antibody. Patients with smooth muscle antibody had a greater prevalence of abnormalities of all liver function tests, rheumatoid factor, mitochondrial antinuclear, and salivary duct antibodies, and hepatomegaly than those who were smooth muscle antibody-negative. In rheumatoid arthritis, higher serum alkaline phosphatase levels were correlated with higher articular indices, erythrocyte sedimentation rate (ESR), and serum globulin levels. The obverse was true of patients with sicca syndrome, in whom higher serum alkaline phosphatase levels were correlated with higher BSP excretion values. Higher BSP excretion values also correlated

with longer disease duration, higher ESR, and higher serum alkaline phosphatase levels in patients with rheumatoid arthritis and Sjogren's syndrome. Screening for smooth muscle antibody and mitochondrial antibody should provide a useful indication of underlying or associated liver disease in rheumatoid arthritis and other collagenoses.

3370 HODGKIN'S DISEASE AND THE LIVER. *(E.)*
Cowan, R.; Trounce, J. R. (Greenwich Hosp. Gastrointest. Unit, London, England). *Guys Hosp. Rep.* 122(384):221-230, 1973.

Two patients who developed jaundice during the course of Hodgkin's disease are described to illustrate some of the difficulties encountered in the diagnosis and managment of this complication. Although the symptoms of liver disease were clear in both patients (2 men, aged 49 yr and 19 yr, resp.) seriously defective blood coagulation in both cases ruled out liver biopsy, laparoscopy, and laparotomy. The indirect methods of assessing liver disease by liver function tests had considerable limitations, largely because of the lack of specificity of such tests. In both patients, the most unequivocal evidence for liver involvement was a raised level of conjugated bilirubin associated with bilirubinuria, which indicated simply that the liver was abnormal. In general, a marked rise in hepatic transaminases indicates that dead or damaged hepatocytes are leaking their intracellular enzymes into the extracellular fluid; a fall in transaminases indicates that dead or damaged hepatocytes are leaking their intracellular enzymes into the extracellular fluid; a fall in transaminases may indicate overwhelming damage to the liver cell mass. Alkaline phosphatse is a useful indicator of early or focal infiltration of the liver and at such time is commonly the only abnormal liver function parameter. BSP and indocyanine green excretion tests may be used in the serial assessment of overall liver function. Isotope scanning of the liver is useful in visualizing discrete intra-hepatic lesions, and many conditions may be detected as focal abnormalities by this technique. Although liver biopsy has the most diagnostic potential of any test discussed, it requires that the patient have adequate clotting factors. With the availability of effective therapeutic agents for Hodgkin's disease, hepatic involvement should be evaluated and its progress followed carefully. Combination chemotherapy is the best form of drug treatment available, but irradiation of the liver also has a place in the treatment of liver involvement by Hodgkin's disease.

3371 REVERSAL OF SEVERE FATTY HEPATIC INFILTRATION AFTER INTESTINAL BYPASS FOR MORBID OBESITY BY CALORIE-FREE AMINO ACID INFUSION. *(E.)*
Heimburger, S. L.; Steiger, E.; Lo Gerfo, P.; Biehl, A. G.; Williams, M. J. (Keesler Air Force Base, Miss.). *Am. J. Surg.* 129:229-235, 1975.

The successful nonoperative treatment of 3 women in whom fatty metamorphosis developed in the liver after jejunoileal bypass for morbid obesity is reported. In 3 of 13 patients who underwent 6-12 in jejunoileal bypass procedures, symptomatic hepatomegaly developed with near total replacement of the hepatocytes by massive fatty infiltration. After undergoing liver scan, liver biopsy, and liver function tests, the patients were started on a peripheral infusion of 4.45% crystalline amino acid solution (2, l/day), which allowed for fat mobilization while preserving body protein stores. At the end of a 14-21 day infusion period, the serum albumin levels increased by 1 g in all 3 patients; decreases in liver volume of 83, 45, and 40% were also observed. During the infusion period, ketonuria was 4+ in all patients, indicating active lipolysis. Weight losses of 17, 19, and 40 lb occurred. All patients showed marked symptomatic improvement, and postinfusion liver biopsy specimens showed a return to near normal architecture. During a subsequent 5-7 month follow-up period, normal liver size was maintained by a high-protein, low-carbohydrate diet. Hepatic fatty infiltration complicating jejunoileal bypass can be massive and may require restoration of gastrointestinal continuity. This fatty infiltration appears to be caused by protein depletion associated with adequate or high carbohydrate intake. In contrast to standard hyperalimentation solutions, the use of calorie-free amino acid solutions reverses the hepatic infiltration by mobilization of fat. This fat mobilization does not occur as readily in the presence of large amounts of glucose.

3372 IRON ABSORPTION IN NORMAL SUBJECTS AND PATIENTS WITH IDIOPATHIC HAEMOCHROMATOSIS: RELATIONSHIP WITH SERUM FERRITIN CONCENTRATION. *(E.)*
Walters, G. O.; Jacobs, A.; Worwood, M.; Trevett, D.; Thomson, W. (Welsh Natl. Sch. Med., Cardiff). *Gut* 16(3):188-192, 1975.

The relationship between iron stores and iron absorption was studied in 52 healthy adults (22 women) and 15 patients (14 men) with primary idiopathic hemochromatosis. Iron absorption was measured by whole body counting using a flat bed scanning technique; measurements were made before, immediately after, and 14 days after consumption of chicken soup containing 2 mg iron and 0.5 μCi (^{59}Fe) ferric citrate. Iron stores were measured by determination of the serum iron concentration. In the normal subjects, there was a significant negative correlation between serum ferritin concentration and iron absorption; there was no correlation between iron absorption and hemoglobin concentration, serum iron concentration, or transferrin saturation. The mean iron absorption in the normal subjects was 12.6%, and that in the hemochromatosis patients was 2.19%. Although there was a significant negative correlation between serum ferritin concentration and iron absorption in the patients, the mean iron absorption (30%) in patients with normal ferritin concentration was significantly higher than the mean absorption in normal subjects with similar ferritin concentrations. Thus, iron absorption in the hemochromatosis patients corre-

sponded to normal levels only when the serum ferritin concentration was significantly elevated above normal values. In the patients, there was a correlation between chelatable iron and serum ferritin concentration, but not between iron absorption and chelatable iron. The ratio of chelatable iron to ferritin was positively correlated with iron absorption. The data confirm the high iron absorption in hemochromatosis patients in relation to their iron load and support the view that this is associated with an imbalance between chelatable iron and ferritin synthesis.

3373 CANCER OF THE BILE DUCTS ASSOCIATED WITH ULCERATIVE COLITIS. *(E.)* Akawari, O. E.; Van Heerden, J. A.; Fould, W. T.; Baggenstoss, A. H. (Mayo Clin., Rochester, Minn.). *Ann. Surg.* 181(3): 303-309, 1975.

Thirteen cases of bile duct cancer associated with ulcerative colitis were reviewed. These cases represented 0.0062% of all autopsy cases at the Mayo Clinic in the period 1935-1973; they represented 1.6% of all autopsy cases of bile duct cancer in the same period. The mean age at onset of ulcerative colitis was 19 years, in each case the onset being marked by severe diarrhea. After initial severe symptoms, most patients developed a pattern of mild-to-moderate disease with exacerbations and remissions. In 10 patients, the ulcerative colitis was managed by various regimens aimed at symptomatic relief and support; proctocolectomy or total colectomy was performed in 3 cases. In one patient, ulcerative colitis was complicated by colonic cancer. The mean age at onset of symptoms of bile duct cancer was 38 yr. Mode of management of the preceeding colitis did not appear to affect the pattern of disease leading to the onset of bile duct cancer which was insidious in all cases. Symptoms included anorexia followed by progressive jaundice. The tumor had spread beyond the bile ducts in 10 patients by the time cancer was diagnosed. The tumors were difficult to identify and often infiltrated the hepatic hilus. Only 1 patient was considered suitable for curative resection; this patient survived for 31.3 months. Histologically, all patients had adenocarcinomas. In no instance was associated cholelithiasis present. The mean survival period was 18.8 months, with hepatic failure, sepsis, shock, and renal shutdown preceeding death. This series of patients combined with the cases reported in the literature suggest that the association between chronic ulcerative colitis and bile duct cancer is more than chance.

3374 FATTY ACID COMPOSITION OF LIVER TRIGLYCERIDES IN VARIOUS STAGES OF FAT DEPOSITION IN THE PARENCHYMA. *(E.)* Singer, P.; Gnauck, G.; Honigmann, G.; Stolz, P.; Schliack, V.; Thoelke, H.; Kettler, L. H.; Buntrock, P. (Clin. Diabetes Assoc. Dis., Berlin, Germany). *Acta Diabetol. Lat.* 11(1):32-42, 1974.

The relation between the fatty acid pattern of triglycerides, and fat droplet size in hepatocytes was investigated. Biopsy specimens were obtained from 30 diabetic inpatients. One part of each specimen was fixed in formalin for histological study, and the remainder was prepared for gas-liquid chromotography. Hepatocytes were classified into four stages according to fat droplet size, by means of an ocular net: normal (no droplets); small droplets (1.7-6.6 μm); medium droplets (7.9-24.0 μm); and large droplets (20.8-50.0 μm). With increasing droplet size a significant increase in palmitic acid (15.0%-28.7%) and oleic acid (19.3%-45.4%) was found. Significant decreases were found in arichidonic and eicosapentanoic acids (3.6%-0.4% and 25.6%-1.6%, resp.). There was also a slight decrease in myristoleic acid. It is concluded that oleic and palmitic acids are predominant in the fat deposited in the liver as well as adipose tissue.

3375 HEPATIC ARTERY LIGATION AND POSTOPERATIVE CHEMOTHERAPY FOR HEPATIC METASTASES: CLINICAL AND PATHOPHYSIOLOGICAL RESULTS. *(E.)* Sparks, F. C.; Mosher, M. B.; Hallauer, W. C.; Silverstein, M. J.; Rangel, D.; Passaro, Jr., E.; Morton, D. L. (Sepulveda VA Hosp., Los Angeles, Calif.). *Cancer* 35(4):1074-1082, 1975.

The effect of a combination of hepatic artery ligation and postoperative chemotherapy on 19 patients with multiple bilateral unresectable metastases, limited to the liver was investigated. In 13 patients the metastases originated from colorectal carcinoma, and in six from other primary cancers. Chemotherapy alone had been tried unsuccessfully in 16 of the patients. In all but one patient the hepatic artery was exposed within the portal triad, doubly ligated, and divided between the gastroduodenal and cystic arteries. In one patient with gastronoma, only the left branch of the hepatic artery was ligated. Cholecystectomy was performed routinely where the gallbladder was present. In four patients, the inferior phrenic arteries were ligated also, and the falciform, round and triangular ligaments were divided. Postoperatively, oxygen was given by mask or nasal catheter to raise the O_2 pressure in the portal blood. Glucagon was given to three patients. Ligation was not performed in several cases when tumor growth was so extensive as to limit the quality and length of survival. In the 10 patients with colorectal carcinoma in whom ligation was performed, 5-fluorouracil therapy was begun immediately after recovery, by the systemic route in nine, and by catheter into the ligated distal hepatic artery in one patient. The six patients with metastases from other sources were given several different drugs. Sixteen patients survived surgery and were followed up for 19 months. Of the patients with colorectal carcinoma metastases, symptoms improved in four for 4, 4, 16, and 33 weeks. One patient, asymptomatic prior to surgery, remained so for 48 weeks postoperatively, and liver scans showed no changes during this time. In three of seven other patients liver scans showed improvement. Liver size decreased in four patients. Six patients died from 12-72 weeks after surgery. Three patients died

from preventable complications, including cardiac arrhythmia, liver laceration during paracentesis, and renal failure. Of the six patients with metastases from other sources, symptoms improved in four patients for 16, 20, 40, and 43 weeks. Liver scans showed improvement in three from 20-43 weeks. Liver size decreased in one for 40 weeks. Four died 83, 40, 20, and 8 weeks after surgery. One had leiomyosarcoma and had initially refused chemotherapy. After 20 weeks of improvement, tumor growth resumed and was resistant to chemotherapy. One patient with melanoma did not respond to combination immunotherapy and chemotherapy, and died after 20 weeks. The overall mortality rate was 16%. Mortality was higher in patients with metastases comprising over 30% of liver volume. It is concluded that hepatic artery ligation and postoperative chemotherapy is effective in selected patients.

3376 CLINICAL ASSESSMENT OF LIVER SIZE IN NORMAL CHILDREN. *(E.)* Younoszai, M. K.; Mueller, S. (Coll. Med., Univ. Iowa, Iowa City). *Clin. Pediatr.* 14(4):378-387, 1975.

Clinical evaluation of liver size by percussion and palpation was tested in 105 children from 5 yr 4 months to 12 yr 3 months in age. The children were placed supine with knees flexed at maximum inspiration. The lower edge of the organ was determined by palpation in the mid-clavicular line, and the upper edge of liver dullness was determined by percussion. Both limits were marked by masking tape and the distance between them measured to the nearest mm and recorded as liver span. The distance between the lower edge of the liver and the costal margin in the right mid-clavicular line; and liver height in the mid-sternal line were measured by the same method. After measurements were made by one investigator, the markings were removed and meausrements were made by a second investigator. These were smaller by 0.4 cm in the boys and 0.2 cm in the girls than those of the first investigator. The correlation coefficient between corresponding measurements of the two investigators was statistically significant. When the liver span of each child was plotted against body weight and age, the slopes of the regression lines were significantly different than zero. The correlation coefficient between liver span and body height was statistically significant, increasing from 7 cm at 5 yr to 9 cm at 12 yr. Measurements of liver height in the mid-sternal region gave no consistent results. Measurements of the liver edge below the costal margin were variable. The maximal difference between investigators was 3.3 cm, while the maximal value was 8 cm. The correlation coefficient between the two sets of measurements was not statistically significant. It is concluded that liver span can be reliably measured in children, as in adults, by percussion and palpation.

3377 THE SELECTIVE INHIBITION OF CHENODEOXYCHOLATE SYNTHESIS BY CHOLATE METABOLITES IN MAN. *(E.)* Pomare, E. W.; Low-Beer, T. S. (Bristol R. Infirm., England). *Clin. Sci. Mol. Med.* 48(4): 315-321, 1975.

Pool size and rate of bile salt synthesis were studied in four volunteers by radioisotopic methods. Measured amounts of 24-^{14}C-cholate and chenodeoxycholate containing 3-4 μCi radioactivity each, were simultaneously injected i.v. after an overnight fast. Duodenal contents were aspirated after 3, 24, 48, 72 and 96 hr, and bile salt kinetics were calculated by the isotope dilution technique. Bile salts were separated by thin layer chromatography, chenodeoxycholate further separated from deoxycholate, and their specific radioactivities determined by liquid scintillation counter. Relative proportions of the three bile salts were measured by the 3α-hydroxysteroid dehydrogenase enzyme used to assay cholate, and the salicylaldehyde reaction used to assay deoxycholate. Several days after this first study, the subjects were given capsules containing 0.128 mM deoxycholate. Three subjects with chenodeoxycholate rates of 0.25-0.37 mM/day took the capsules twice daily with the meals, while the fourth (synthesis rate: 0.61 mM/day) took three capsules daily. A second study was begun 16, 29, and 32 days after starting the deoxycholate in the first three subjects (15 with gallstones, 13 cholecystectomized, eight with adult celiac disease, and 28 normal). Deoxycholate administration significantly expanded the deoxycholate pool. This was associated with a significant fall in pool size and synthesis rate of chenodeoxycholate with no change in its half-life, but there was no effect on any of these parameters of cholate. There was no consistent change in total bile salt pool, but total primary bile salt synthesis decreased in three of four subjects. There was an inverse relationship between the percentages of deoxycholate and chenodeoxycholate in all four subjects plus three from a previous study, and the 62 fasting subjects not given bile salts. It is concluded that deoxycholate regulates the size of the chenodeoxycholate pool independently of total bile salt pool size.

3378 SERUM α-FETOPROTEIN CHANGES AFTER PARTIAL HEPATECTOMY IN MAN. *(Ger.)* Lamerz, R.; Grunst, J.; Fateh-Moghadam, A.; Schmalhorst, U.; Pichlmaier, H.; Eisenburg, J. (1st Med. Clin., Univ. Munich, Germany). *Klin. Wochenschr.* 53(3):129-133, 1975.

α-Fetoprotein (AFP) was determined by radioimmunoassay on sera from four patients with serologically and histologically confirmed hydatid disease of the liver before and 1-63 days after surgery. Of these patients, two underwent resection of the left lobe; one of the entire right lobe; and one of half the right lobe. A patient who underwent thyroidectomy with the same type of anesthesia served as a control. Before surgery all patients had serum AFP concentrations in the normal range (below 20 ng/ml). However, 1-3 days after surgery AFP concentrations increased to a maximum of 2760 to 5600 ng/ml, i.e. 130-280

times the upper normal limit. Thereafter, the AFP concentration decreased, rapidly at first and then more slowly. In two cases normal values were found 35 and 53 days, resp., after surgery. The control had normal AFP concentrations both before and after surgery. Increases in serum AFP concentrations after partial hepatectomy are attributed to rapid liver cell regeneration.

3379 CYTOLOGICAL DIAGNOSIS OF HEPATIC METASTASES FROM A MALIGNANT MELANOMA ON A BIOPSY OBTAINED WITH AN ORDINARY NEEDLE. *(Ser.)* Djordjevic, M.; Stajic, M.; Begic-Janev, A.; Teodorovic, J.; Tomin, R. (Med. Fac., Univ. Belgrade, Yugoslavia). *Srp. Arh. Celok. Lek.* 102(3/4):269-274, 1974.

3380 KUPFFERIAN HEMANGIOENDOTHELIOSARCOMA OF THE LIVER (KUPFFER CELL SARCOMA): TWO CASES. *(Sp.)* Gentili, V.; Vales, O.; San Roman, A. (G. Rawson Hosp., Buenos Aires, Argentina). *Rev. Esp. Enferm. Apar. Dig.* 44(8):811-816, 1974.

3381 HEPATOSPLENIC SARCOIDOSIS ASSOCIATED WITH HEPATIC SCHISTOSOMIASIS. *(Fr.)* Dry, J.; Leynadier, F.; Huguier, M.; Pradalier, A.; Roger, M. (Rothschild Hosp., Paris, France). *Nouv. Presse Med.* 4(4):269-270, 1975.

3382 DNA SYNTHESIS IN HUMAN LIVER BIOPSIES. *(Ger.)* Safrany, L.; Tulassay, Z.; Kopper, L. (1st Med. Clin., Semmelweiss Univ., Budapest, Hungary). *Z. Gastroenterol.* 13(1):23-26, 1975.

3383 THE LIVER AND PREGNANCY. *(It.)* Carollo, F. (Inst. Clin. Obstet. Gynecol. I, Univ. Palermo, Italy). *Minerva Ginecol.* 26(9):542-556, 1974.

3384 EFFECT OF MASSIVE BLOOD TRANSFUSIONS ON LIVER FUNCTION AS RELATED TO BLOOD STORAGE TIME. *(Rus.)* Iakobson, M. M.; Kniazeva, G. D.; Guseinov, Ch. S.; Rakhmaeva, V. A. (A. V. Lunacharskii Med. Inst., Astrakhan, USSR). *Khirurgiia (Mosk.)* (3):74-79, 1973.

3385 ORAL CONTRACEPTIVES AND LIVER FUNCTION. *(It.)* Cittadini, E.; Catalano, G. (Inst. Clin. Obstet. Gynecol. I., Univ. Palermo, Italy). *Minerva Ginecol.* 26(9):533-541, 1974.

3386 SEX STEROIDS AND LIVER FUNCTION. *(It.)* Maneschi, M.; Martorana, A. (Inst. Clin. Obstet. Gynecol. II, Univ. Palermo, Italy). *Minerva Ginecol.* 26(9):526-532, 1974.

3387 CHANGES IN THE ACTIVITY OF TESTOSTERONE-ACTIVATING ENZYMES IN HUMAN HEPATIC TISSUE IN CHOLESTASIS AND CIRRHOSIS. *(Ger.)* Littman, K. P.; Winter, G.; Gerdes, H. (Med. Clin., Univ. Marburg, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:1258-1261, 1973.

3388 DIAGNOSING THE CAUSE OF HEPATOCELLULAR AND OBSTRUCTIVE JAUNDICE: REVIEW OF 100 CASES. *(Sp.)* Liso, P.; Alves, J.; Santolaria, F.; Huguet, R.; Cabarcos, A.; Bruguera, J. A.; Conchillo, F. (Fac. Med., Navarra Univ., Pamplona, Spain). *Rev. Esp. Enferm. Apar. Dig.* 44(8):753-766, 1974.

3389 BIOCHEMICAL AND CLINICAL ASPECTS OF WILSON'S DISEASE. *(Pol.)* Drozdz, M.; Kucharz, E.; Kozolowski, A. (Silesian Acad. Med., Katowice, Poland). *Przegl. Lek.* 31(9):310-314, 1974.

3390 GLYCOGEN STORAGE DISEASES. *(Fr.)* Pignon, G. (no affil.). *Rev. Fr. Gastroenterol.* (99):17-20, 23-25, 26, 30, 1974.

3391 TRAUMATIC RUPTURE OF THE LIVER. THE PLACE OF SUBSEQUENT HEPATECTOMY. *(Fr.)* Ribet, M.; Leplat, F.; Faillon, J. M.: Mulliez, P.; Wurtz, A.; Henriet, P. (Univ. Hosp. Cent., Lille, France). *Lille Chir.* 29(2):59-65, 1974.

3392 NOMOGRAM FOR ESTIMATING NORMAL LIVER WEIGHTS. *(E.)* Eldridge, J. E.; Capurro, P. U. (Union Hosp. Cecil Cty., Elkton, Md.). *J. Nucl. Med.* 16(4):314, 1975.

3393 TRADITION AND INNOVATION: REFLECTIONS ON SELECTED HISTORICAL HIGHLIGHTS IN THE FIELD OF HEPATIC SURGERY. *(E.)* Gans, H. (New York Hosp.-Cornell Univ. Med. Cent., N.Y.). *Surgery* 77(4):593-601, 1975.

3394 SEVENTEEN CASES OF HEPATECTOMY. *(E.)* Lannon, J. (Johannesburg Gen. Hosp., South Africa). *S. Afr. J. Surg.* 12(4):227-232, 1974.

3395 THE IMMUNOLOGIC BASIS OF LIVER DISEASE. *(E.)* Popper, H. (Mt. Sinai Sch. Med., City Univ. New York, N.Y.). *Bull. NY Acad. Med.* 51(4): 519-527, 1975.

3396 SIMULTANEOUS MEASUREMENT OF BROMSULPHALEIN [SIC!] INITIAL DISTRIBUTION VOLUME AND ^{131}I-ALBUMIN PLASMA VOLUME IN PATIENTS WITH LIVER DISEASE. A STUDY OF 195 PATIENTS AND A REVIEW OF THE LITERATURE. *(E.)* den Blaauwen, D. H.; Thijs, L. G.; Roos, P. (Free Univ. Hosp., Amsterdam, Netherlands). *Gastroenterol. Belg.* 37(7/8):313-338, 1974.

3397 THE ANTERIOR APPROACH TO PERCUTANEOUS LIVER BIOPSY. *(E.)* Kondi, E. S.; Gallitano, A. L. (Boston, Univ. Med. Cent., Mass.). *Surg. Gynecol. Obstet.* 140(3):423-424, 1975.

3398 THE GLYCOSAMINOGLYCANS IN HUMAN HEPATIC CANCER. *(E.)* Kojima, J.; Nakamura, N.; Kanatani, M.; Ohmori, K. (Cent. Adult Dis., Osaka, Japan). *Cancer Res.* 35(3):542-547, 1975.

3399 ULTRASOUND MONITORING OF HEPATIC METASTASES DURING CHEMOTHERAPY. *(E.)* Gilby, E. D.; Taylor, K. J. W. (Inst. Cancer Res., Sutton, England). *Br. Med. J.* 1(5954):371-373, 1975.

3400 PRIMARY HEPATIC CANCER IN INFANCY AND CHILDHOOD. A SURVEY OF TWENTY CASES. *(E.)* Sinniah, D.; Campbell, P. E.; Colebatch, J. H. (R. Child. Hosp., Parkville, Australia). *Prog. Pediatr. Surg.* 7:141-170, 1974.

3401 EXTENSIVE CALCIFICATION IN THE STROMA OF A PRIMARY HEPATIC CARCINOMA. *(E.)* Moenandar, I. M. (Dep. Pathol., Univ. Leiden, Netherlands). *J. Pathol.* 114(1):53-54, 1974.

3402 HEPATIC ANGIOSARCOMA. *(E.)* McAllister, Jr., H. A.; Ishak, K. G. (Armed Forces Inst. Pathol., Washington, D.C.). *Am. J. Clin. Pathol.* 63(4):601, 1975.

3403 TRAUMATIC INTRAHEPATIC HEMATOMA. REPORT OF A CASE. *(E.)* Solheim, K.; Bugge-Asperheim, B. (Ulleval Hosp., Oslo, Norway). *Acta Chir. Scand.* 140(8):667-669, 1974.

3404 REYE'S SYNDROME IN MICHIGAN: THE 1974 EPIDEMIOLOGIC EXPERIENCE. *(E.)* Thompson, T. R.; Gordon, R. C.; Baublis, J. V. (Michigan Dep. Public Health, East Lansing). *Mich. Med.* 74(6):69-73, 1975.

3405 JAUNDICE FOLLOWING BURNS. *(Ger.)* Chlumsky, J.; Vrabec, R.; Chlumska, A. (Fac. Med. Hyg., Charles Univ., Prague, Czechoslovakia). *Dtsch. Z. Verdau. Stoffwechselkr.* 34(2-4):237-239, 1974.

3406 INTRAHEPATIC CHOLEDOCHAL CYST. *(E.)* Rangabashyam, N.; Krishnaraj, B.; Mohan, C.; Ramakrishnan, V. (Stanley Med. Coll., Madras, India). *Am. J. Gastroenterol.* 63(1):71-74, 1975.

3407 FIBRINOID NECROSIS OF LIVER PARENCHYMAL CELLS. *(E.)* Sumegi, I. (Karolinska Hosp., Stockholm, Sweden). *Acta Pathol. Microbiol. Scand. [A]* 83(1):109-119, 1975.

3408 CAN COLONIC BACTERIAL METABOLITES PREDISPOSE TO CHOLESTEROL GALL STONES? *(E.)* Low-Beer, T. S.; Pomare, E. W. (Bristol R. Infirm., England). *Br. Med. J.* 1(5955):438-440, 1975.

3409 ENCEPHALOPATHY AND FATTY DEGENERATION OF THE VISCERA (EFDV): BIOCHEMICAL CHARACTERIZATION. *(E.)* Alvira, M. M.; Forman, D. T. (Evanston Hosp., Ill.). *Am. J. Clin. Pathol.* 63(4):600, 1975.

3410 HYDATID DISEASE IN CHILDREN. *(E.)* Auldist, A. W.; Myers, N. A. (R. Child. Hosp., Melbourne, Australia). *Aust. NZ J. Surg.* 44(4):402-407, 1974.

3411 UNUSUAL PRESENTATION OF A HEPATIC HYDATID CYST. *(E.)* Bose, S. M.; Monga, N. K. (Inst. Med. Educ. Res., Chandigarh, India). *Aust. NZ J. Surg.* 44(4):407-409, 1974.

See also, 2418, 2629, 2874, 2875, 2892, 2914, 2919, 2920, 2921, 2922, 2924, 2925, 2928, 2929, 2936, 2937, 2938, 2939, 2947, 2953, 2955, 2963, 3017, 3032, 3305, 3336, 3412, 3419, 3441, 3520, 3523, 3533, 3538, 3539, 3544, 3567, 3607, 3690, 3744, 3746, 3752, 3772.

LIVER AND BILIARY TRACT

Hyperbilirubinemic States

3412 MANAGEMENT OF YOUNG INFANTS PRESENTING WITH DIRECT-REACTING HYPERBILIRUBINEMIA. *(E.)* Sass Kortsak, A. (Dep. Pediatr., Univ. Toronto, Canada). *Pediatr. Clin. North Am.* 21(4):777-799, 1974.

Early detection followed by immediate and intensive investigation is essential for the survival of young infants with direct-reacting hyperbilirubinemia, with an aim toward a specific diagnosis of the underlying disease. Failure to arrive at a diagnosis results in having to distinguish between extrahepatic biliary atresia and other extrahepatic bile duct anomalies which are potentially correctable by surgery on the one hand, and intrahepatic disease leading to cholestasis (neonatal hepatitis syndrome) on the other. The degree of biliary obstruction must be determined and, if complete obstruction is found, whether it is sustained with the passage of time. Serum 5'-nucleotidase and bile acid studies are helpful at this point

in the diagnosis. Liver function tests and needle biopsy of the liver also help. Patients with strong suspicion of extrahepatic biliary atresia should undergo surgical exploration between 2-3 months of age or earlier, but not before all avenues of investigation that may lead to another specific diagnosis or may exclude the diagnosis of biliary atresia are exhausted. Patients with long-standing severe cholestasis require dietary management and fat-soluble vitamin supplementation in excess of the normal requirements for maintenance. Patients with long-standing intrahepatic cholestasis may benefit from cholestyramine and/or phenobarbital.

3413 UNCONJUGATED HYPERBILIRUBINEMIA: PHYSIOLOGIC EVALUATION AND EXPERIMENTAL APPROACHES TO THERAPY. *(E.)* Berk, P. D.; Martin, J. F.; Blaschke, T. F.; Scharschmidt, B. F.; Plotz, P. H. (Natl. Inst. Arthritis Metab. Dig. Dis. Bethesda, Md.). *Ann. Intern. Med.* 82(4):552-570, 1975.

A physiologic approach to the evaluation of patients with unconjugated hyperbilirubinemia was described, along with a case study of a patient with Crigler-Najjar syndrome and a review of established and experimental methods used to reduce the plasma unconjugated bilirubin concentration. Kinetic studies with radiolabeled bilirubin provided for measurement of the rate at which newly synthesized bilirubin entered the plasma and the rate of hepatic bilirubin removal. Quantitation of both of those variables permitted a precise classification of patients with unconjugated hyperbilirubinemia into those with increased bilirubin production, those with decreased hepatic bilirubin clearance (Gilbert's syndrome), and those in which both factors played a role. A rare case of Crigler-Najjar syndrome was described in which bilirubin encephalopathy developed at 18 yr. Various procedures were used in an attempt to reduce the patient's plasma bilirubin concentration by either increasing bilirubin clearance or reducing bilirubin turnover: drug therapy, phototherapy, and phlebotomy. None of those methods were effective in relieving the patient's jaundice but led to further investigations into specific methods of removing bilirubin from the blood. Hemoperfusion experiments in animals gave results that appeared potentially useful for clinical problems. The studies offered new information about the metabolism of bilirubin in type-1 congenital nonhemolytic jaundice, and suggest that the alternate metabolic pathways by which bilirubin is excreted in this syndrome are in some way dependent on the rate of bilirubin production.

3414 INHERITANCE OF THE DUBIN-JOHNSON-SPRINZ SYNDROME. *(E.)* Edwards, R. H. (Armed Forces Inst. Pathol., Washington, D.C.). *Gastroenterology* 68(4):734-749, 1975.

To establish the mode of inheritance of the Dubin-Johnson-Sprinz (DJS) syndrome, propositi were ascertained through liver biopsies of jaundiced patients, pedigree information on propositus families obtained through questionnaires, and the presence or absence of the syndrome in relatives determined by liver function tests Conjugated hyperbilirubinemia and elevated BSP levels (higher at 120 min than at 45 min), characteristic of the DJS syndrome, were observed in 17 of 44 tested siblings of 44 DJS patients. Results of these liver function tests on all of 20 parents and 64 children of propositi indicated that they were not affected. Parents of 11 of 39 DJS patients were reportedly consanguineous. The high frequency of parental consanguinity, the incidence of the syndrome among siblings of patients, the lack of involvement of more than 1 generation within each family, and consideration of other reports of familial DJS syndrome suggest the syndrome is inherited only as an autosomal recessive trait. Reports of cases inherited as a dominant trait are probably due to erroneous diagnosis of propositi or their relatives or to pseudodominant inheritance of the recessive trait. Appreciation of this mode of inheritance may be helpful in the differential diagnosis of the constitutional hyperbilirubinemias and in the elucidation of the nature of the hepatic excretory defect in the DJS syndrome and other constitutional hyperbilirubinemias (Gilbert's and Rotor's syndromes).

3415 LIVER ULTRASTRUCTURE IN GILBERT'S SYNDROME. *(E.)* McGee, J. O'D; Allan, J. G.; Russell, R. I.; Patrick, R. S. (R. Infirm., Glasgow, Scotland). *Gut* 16(3):220-224, 1975.

Nine young patients with Gilbert's syndrome were studied, 4 of whom had no symptoms in association with the episodes of jaundice, 3 who complained of nausea, tiredness, and headache, and 2 who had abdominal discomfort. Light microscopy of all liver specimens revealed no abnormality. No hemosiderin or visible bile pigment was observed. Lipochrome pigment in centrilobular zones was rarely prominent and was only sometimes seen in liver biopsies from patients with no disorder of bilirubin metabolism. Similarly the electron microscopic examination showed no abnormalities. Pigmented bodies were not observed in excessive numbers and there were none of the degenerative features in plasma membranes, mitochondria, or sinusoidal cells described by other reports. The rough endoplasmic reticulum was not damaged although the amount was apparently reduced in some hepatocytes. In every case

agranular endoplasmic reticulum was very prominent and fairly uniform between the individual parenchymal cells. In only 1 case was there any conspicuous dilatation of these vesicular structures, probably due to some delay in fixing the tissues for electron microscopy. There was a 3- to 9-fold increase in agranular endoplasmic reticulum in these cases. This excess agranular endoplasmic reticulum was the only consistent and notable feature of hepatocyte ultrastructure. None of these 9 patients was alcoholic or had been addicted to phenobarbital or other drugs known to cause hypertrophy of agranular endoplasmic reticulum. It is suggested that this ultrastructural feature may be part of Gilbert's syndrome and could have some diagnostic significance in the investigation of doubtful cases of unconjugated hyperbilirubinemia.

3416 THE METABOLISM OF SULFOBROMOPHTHALEIN (BSP) IN DUBIN-JOHNSON DISEASE. *(Sp.)* Gibert-Queralto, J.; Rodes, J.; de Zubizarreta, A.; Bruguera, M. (Fac. Med., Barcelona, Spain). *Fegato* 19(2):481-497, 1973.

Plasma clearance curves for BSP were studied in four patients with Dubin-Johnson syndrome. Each patient received 5 mg/kg of BSP i.v., and BSP concentrations were measured in blood samples taken 8-150 min after injection of the dye. These plasma clearance curves for BSP were very similar in all four patients: a rapid decrease occurred until 30-45 min after injection, after which total plasma BSP concentrations continued to increase slowly until 120-150 min after injection. At 45 min, BSP retention was increased in three patients and normal in one. The percentage of BSP which returned to the circulation between 45 and 120 min after injection ranged from 10.35% to 12.39% in three cases, i.e. total plasma BSP concentrations were increased to almost the same extent. These findings demonstrate that uptake of BSP by the liver is normal in Dubin-Johnson syndrome, but once the point of saturation is reached, serum BSP levels decrease more slowly in patients with Dubin-Johnson syndrome than in normal subjects. It is suggested that these abnormalities are due to impaired excretion of conjugated BSP from the liver into the biliary tract. This was confirmed by measuring free and conjugated BSP fractions in the serum by thin-layer chromatography on silica gel G and elution with a mixture of *n*-butanol, acetic acid, and water (4:1:6) for 24 hr. Plasma clearance curves for BSP obtained from these patients differed from those in extrahepatic obstructive jaundice and hepatic amyloidosis. In the latter two diseases, the increases in plasma BSP concentrations occurred later (75 min after injection) and more slowly than those in Dubin-Johnson syndrome. BSP retention at 45 min was pronounced in extrahepatic obstructive jaundice but not in Dubin-Johnson syndrome or hepatic amyloidosis. It is suggested that plasma clearance curves for BSP might prove useful in the diagnosis of Dubin-Johnson syndrome, providing that hepatic biopsies were taken for confirmation.

3417 COMPARISON OF TREATMENTS FOR CONGENITAL NONOBSTRUCTIVE NONHAEMOLYTIC HYPERBILIRUBINAEMIA. *(E.)* Arrowsmith, W. A.; Payne, R. B.; Littlewood, J. M. (Seacroft Hosp., Leeds, England). *Arch. Dis. Child.* 50(3):197-201, 1975.

Alternatives to phototherapy for treatment of Arias type 1 Crigler-Najjar syndrome were investigated. A 2-yr-old female developed jaundice at 16 hr of age. Total serum bilirubin was 12.4 mg/100 ml, of which 0.6 was conjugated. Phototherapy treatment was begun and continued for 2 yr. During that time, bilirubin levels ranged from 10-28 mg/100 ml, but mental and physical development remained normal. To eliminate the need for 20 hr phototherapy daily, and allow more normal future development, less restrictive methods of therapy were investigated including potassium aspartate (300 mg twice daily), high fat diet (66.9 g fat/day), phenobarbitone (15 mg/day), uridine diphospho(UDP)-glucose (20 mg twice daily), cholestyramine (2 g twice daily), and agar (1g/kg/day). Each treatment was given for three weeks with three week intervals between treatments. Because of variability during the control period of bilirubin concentration (12-20 ng/100 ml) a statistical method to calculate linear regression for bilirubin concentration on time and its correlation coefficient during each treatment and its control period was developed. The probability that there was a significant linear regression with time, and that the regression was significantly different from the change of bilirubin with time in the control period, was calculated. There was a statistically significant fall with time in serum bilirubin concentration during the treatments with aspartic acid, high fat diet, and cholestyramine. During the high fat diet there was an absolute fall of about 4 mg/100 ml with no gradual progressive change. During cholestyramine treatment there was a highly significant rise in the following control period. The significance of the aspartic acid treatment rested on one pair of values. Continuous cholestyramine therapy was started, and bilirubin values were significantly lower (12.3) after 4 months than in the 8 week control period (15.5) despite reduction in phototherapy time. Present levels range from 9.0-14.0 mg/100 ml. It is concluded that cholestyramine is an effective supplement to phototherapy in the treatment of hyperbilirubinemia.

3418 CONSIDERATIONS OF THE PATHOGENESIS OF NEONATAL HEPATITIS, BILIARY ATRESIA AND CHOLEDOCHAL CYST - THE CONCEPT OF INFANTILE OBSTRUCTIVE CHOLANGIOPATHY. *(E.)* Landing, B. H. (Child. Hosp. Los Angeles, Calif.). *Prog. Pediatr. Surg.* 6:113-139, 1974.

3419 JAUNDICE DUE TO NICOTINIC ACID THERAPY. *(E.)* Einstein, N.; Baker, A.; Galper, J.; Wolfe, H. (Tufts-New Engl. Med. Cent., Boston, Mass.). *Am. J. Dig. Dis.* 20(3):282-286, 1975.

See also, 2595, 2605, 2926, 2927.

3420 HALOTHANE HEPATITIS — A REPORT OF FIVE CASES. *(E.)* Paull, A.; Grant, A. K. (Queen Elizabeth Hosp., Woodville, Australia). *Med. J. Aust.* 1(24):954-957, 1974.

Five cases of acute hepatocellular injury following halothane anesthesia are reported. A 63-yr-old man underwent abdominoperineal resection of the rectum for rectal carcinoma under anesthesia which included halothane. After 21 days cystoscopy was performed, under halothane anesthesia. Five days later a transurethral resection of a hypertrophied prostate was performed, again using halothane. A 60-yr-old woman underwent dilatation and curettage for postmenopausal uterine bleeding under halothane anesthesia. Under halothane anesthesia, an intrauterine radioactive source was inserted 13 days later. Five weeks later, again using halothane, abdominal hysterectomy was performed. A 21-yr-old woman was treated for a vulval abscess, under halothane anesthesia. Six weeks later dental extraction was performed again using halothane. A 55-yr-old man, victim of a boating accident, required four operations during the course of one month and halothane was used as an anesthetic agent on all but the first occasion. A 36-yr-old man had a meniscectomy under halothane anesthesia. About 7 weeks later, hemorrhoidectomy was performed, again using halothane. Each of these patients developed hepatocellular jaundice within 5-12 days after the last exposure to halothane. Liver function tests showed: serum bilirubin 5.9-34 mg/100 ml; SGOT, 100-2800 Karmen U; and alkaline phosphatase, 20-35 King-Armstrong U. No patient had exposure to viral hepatitis nor had any received other known hepatotoxic drugs. In the second case the prothrombin time fell markedly in spite of intramuscular vitamin K therapy and the patient died. In the fourth case, the prothrombin time also fell markedly, but improved after i.m. injections of vitamin K_1. Liver biopsy was performed on every patient and showed changes varying from moderately severe hepatitis to submassive necrosis in the patient who died. It is felt that the incidence of halothane hepatitis can be reduced. It is suggested that halothane not be administered to patients who require several operations within a short period of time, or to those who develop unexplained fever, bilirubinuria, abnormal results on liver function tests or jaundice after its use.

3421 LIVER GRANULOMAS CONTAINING COPPER IN VINEYARD SPRAYER'S LUNG. A NEW ETIOLOGY OF HEPATIC GRANULOMATOSIS. *(E.)* Pimentel, J. C.; Menezes, A. P. (Dep. Pathol., D. Carlos I Sanit., Lisbon, Portugal). *Am. Rev. Resp. Dis.* 111(2):189-195, 1975.

Three cases of a new type of hepatic granulomatosis which may occur in rural workers who spray vineyards with a solution of copper sulfate neutralized with hydrated lime (Bordeaux Mixture) for the prevention of mildew are presented. The cases reported occurred in 3 male rural workers, aged 52-59 yr. In each case the patients' symptoms seem to have been triggered or aggravated by intercurrent infections. The patients were exposed to Bordeaux Mixture from 3-15 yr. Diagnoses were confirmed at autopsy and by lung biopsy and were based on an occupational history and on the finding of granulomas and fibro-hyaline nodular scars containing inclusions of copper. In each case hepatic changes were found by histology which consisted of proliferation and diffuse swelling of Kupffer cells, sometimes showing a tendency to gather in clusters, and the formation of well-defined histiocytic or sarcoid-type granulomas. These lesions were always found near the portal tracts. In the one case where micronodular cirrhosis co-existed, the granulomas were found in the fibrous strands that limited the nodules of regenerated hepatic tissue. Liver lesions were not accompanied by significant clinical or biochemical abnormalities. Micronodular cirrhosis and fatty liver, present in one patient each, were probably related to alcohol intake and not to vineyard sprayer's disease. The granulomas described in the liver of vineyard sprayers are a new type of hepatic granulomatosis which can occur in patients with a pulmonary disease of inhalatory origin. The identification of copper within the lesions, revealed by histochemical techniques, characterizes the nature of these granulomas. The cases presented here suggest that in all patients in whom pulmonary and hepatic granulomas of unknown cause co-exist, or in whom the diagnosis of sarcoidosis is made by exclusion, the possibility of the existence of a disease caused by the inhalation of pathogenic dusts must be considered. A possible aggressive substance within the lesions must be sought, using the appropriate histochemical techniques.

3422 LIVER PATHOLOGY IN CHRONIC BRUCELLOSIS. *(E.)* Boron, P.; Jezyna, C.; Korenkieciwz, I.; Musiatowicz, B. (Bialystok Med. Sch., Poland). *Acta Hepatogastroenterol. (Stuttg.)* 21(4):261-266, 1974.

Functional and morphological estimation of liver pathology was studied in 116 patients (28 women and 88 men, aged 20-68 yr) with chronic brucellosis. The patients were agricultural and veterinary workers with professional exposure from 1-20 yr, in the majority of cases, from 6-14 yr. Examinations showed that in 32% of the cases liver disorders were observed, while hepatomegaly was found in 88%. Mild hyperbilirubinemia (up to 3 mg%) was noted in 20% of the subjects. Elevated SGPT values were observed in about 18% of the patients. Positive sulfobromophthalein tests were noted in 28.5% of those examined. Hypoproteinemia below 6 g% was noted in 12% and hyperproteinemia in 27.2% of the patients. Hypergammaglobulinemia characteristic for observed liver changes was observed in 60%, hypoalbuminemia in 70%, and hyper-α_2-globulinemia in 72%. Only 8 cases (6.9%) of the 116 patients showed inflammatory infiltrations of a focal nature. In the remaining patients, liver changes histologically distinct did not show specificity for brucellosis. Bile stasis was noted in only six cases. Small symptoms of hepatic fibrosis were noted in five cases. In only one patient did the liver biopsy fail to reveal

any pathological changes. In the majority of patients the changes were characteristic of hepatitis *reactiva non specifica*. The content of glycogen in liver cells in clinically active chronic brucellosis was distinctly lower than in cases of clinically nonactive chronic brucellosis and in metabrucellosis. No statistically significant correlation was found between the increasing morphological changes of liver biopsy and the behavior of particular immunoserological reactions. These results indicate that liver pathology in the course of chronic brucellosis has the symptoms of morphological changes and functional disorders. Functional disorders observed on the basis of laboratory parameters rather than on the basis of clinical pictures do not show significant correlation to changes of granulomatous type hepatitis. They are correlated, rather, to the changes of non-specific reaction of liver inflammation.

3423 COAGULATION STUDIES AS A PROGNOSTIC INDEX IN ACUTE LIVER FAILURE. *(E.)* Dymock, I. W.; Tucker, J. S.; Woolf, I. L.; Poller, L.; Thomson, J. M. (Withington Hosp., Manchester, England). *Br. J. Haematol.* 29(3):385-396, 1975.

A series of coagulation tests was employed to determine the relative importance of the various mechanisms for the production of the coagulation defect in 12 patients (11 women and one man, aged 8-71 yr) with acute liver failure. Clinical diagnoses in these patients included viral hepatitis (six), paracetamol poisoning (three); and halothane toxicity (three). All four patients who presented in Grade IV coma died, as did one of the seven Grade II patients and the one Grade III patient. All who died had clinical evidence of bleeding, usually from the alimentary canal. None of the survivors bled. Excessively prolonged prothrombin time ratios were encountered in all patients who died. The three with the least disturbance of prothrombin ratio recovered. The other seven formed an intermediate group with ratios between 3.0 and 4.8, three of whom recovered, and four died. Results of the cephalin time were substantially similar to those of the prothrombin time test with no clear indication of chances of recovery. In both these tests there was a lack of correlation with fibrinogen degradation product titers (FDP). In no patient was the euglobulin lysis time less than 1 hr. Fibrinolysis was not likely the cause of raised FDP titers present in seven patients. Fibrinogen levels show no correlation with elevation of FDP. A reasonable agreement is noted between factor-VII levels and clot opacity. The speed of thrombin/fibrinogen reaction did not correlate well with lowered levels; there is no consistent relation to the chances of survival or to the degree of coma. Factor-VII determinations were performed in 11 of the patients and appeared to be quantitatively related to the chances of survival. Six with a factor-VII level of 9% or above survived, whereas five with a level of 8% or below died. There was not, however, a close relation between factor-VII levels and the grade of coma. Indeed the grade of coma did not appear as good a guide to the chances of survival as did the factor-VII assay. No apparent relation was noted between the FDP level and survival. There was no correlation between the platelet count and the elevation of FDP titer. In conclusion, this study emphasizes the importance of the synthetic ability of the liver in determining the prognosis in acute liver failure. The ability of the factor-VII assay to assess survival chances in individual patients suggests that the assay is a reasonably accurate guide

3424 HISTOMORPHOLOGY OF THE LIVER IN DAMAGE PRODUCED BY PHENOLISATIN-CONTAINING LAXATIVES (RECURRENT CHRONIC CHOLANGITIS AND HEPATITIS). *(Ger.)* Luders, C. J.; Riske, W. E. O.; Henning, H.; Vogel, H. M. (Wenckebach Hosp., Berlin, Germany). *Virchows Arch. [Pathol. Anat.]* 365(4):309-325, 1975.

Semiquantitative histological studies were made of needle biopsies of the liver, obtained at laparoscopy, from 36 women with histories of laxative ingestion. Laxatives containing triacetyl- or diacetylphenolisatin (10-30 mg) were given to these patients 12-24 hr (16 cases), 48 hr (eight cases), 72-96 hr (four cases), or 7-14 days (four cases) before biopsies were taken; two patients received 2 doses each of these laxatives. Before finding out about laxative ingestion, 31 of these patients had the following histological diagnoses: chronic aggressive hepatitis (13 cases), combination of chronic aggressive hepatitis and chronic, nonsuppurating, destructive cholangitis (three cases); inactive chronic hepatitis (eight cases); fibrosis resulting from chronic hepatitis (two cases); and inactive cirrhosis (five cases). Acute phenolisatin-induced liver injury should be considered if biopsies show a combination of chronic aggressive hepatitis with acute cholangiolitis, portal edema, and eosinophilic infiltration. Portal bile ductules show proliferation, infiltration, and destructive changes. The absence of introcanalicular cholestasis rules out a diagnosis of mechanical obstruction of the biliary tract. Signs of inactive chronic hepatitis with portal and septal fibrosis and lymphocytic infiltrates in the portal area are suggestive of phenolisatin-induced damage if neutrophilic or eosinophilic granulocytes are found on closer inspection. The presence of larger numbers of proliferating bile ductules provides further evidence on which to base the diagnosis. Within 3-4 days after laxative ingestion, signs of acute cholangitis begin to regress, but chronic hepatitis is still evident after 7-14 days. The unexpected improvement or recovery of patients with histologically confirmed chronic aggressive hepatitis, primary biliary cirrhosis, or a combination of these two conditions is highly suggestive of drug-induced liver damage, particularly of phenolisatin-induced damage.

3425 CHOLESTATIC HEPATITIS AS AN UNUSUAL ALLERGIC REACTION TO CEPHALOTHIN THERAPY. *(Ger.)*

Schaefer, U. W.; Hackenberg, K.; Reinwein, D. (Clin., Univ. Essen, Germany). *Munch. Med. Wochenschr.* 117(7):251-252, 1975.

A 29-yr-old man with a history of recurrent infection, probably caused by *Streptococcus*, had repeatedly developed allergic reactions to various penicillins. These allergies were marked by exanthemas, swellings of the joints, and enlargements of the lymph nodes. Cephalothin (8 g/day in i.v. infusions) was administered for 18 days. However, after 7 days, increases occurred in direct serum bilirubin, SGOT, SGPT, alkaline phosphatase, leucine aminopeptidase, and lactate dehydrogenase levels. Hepatitis-associated antigen was detected by the complement-fixation test in a titer of 1:16. Urinary bilirubin and urobilinogen concentrations increased, and the patient developed jaundice, mild hepatomegaly, and bilateral pleural effusions. After 17-18 days of cephalothin therapy, the patient's temperature suddenly increased to 39.6 C and the percentage of eosinophils increased to 11%. After discontinuation of cephalothin, the temperature decreased and all of the other pathological findings disappeared, suggesting that this was an allergy. Since the skin was not involved and hepatic symptoms were the most evident, the symptoms observed differ from those classically found in a drug allergy. Because cephalothin is not hepatotoxic, the cholestatic hepatitis is considered to be an immunological hypersensitivity reaction.

3426 THE HEPATOTOXICITY OF LAXITIVES: ADDITIONAL RESULTS ABOUT INGESTION OF PHENOLISATINS AND BISACODYL. *(Ger.)* Henning, H.; Vogel, H. M.; von Braun, H. H. (Fohrenkamp Clin., Fed. Inst. Employee Insur., Molln (Lauenburg), Germany). *Z. Gastroenterol.* 12(1):15-18, 1974.

Diacetyldiphenolisatin (10-30 mg), triacetyldiphenolisatin (10-30 mg), or bisacodyl (20 mg) was given to 460 patients, all but 45 of whom had chronic liver disease. Two doses were given to 24 of these patients. Acute exacerbations of the liver disease occurred in 24 cases, and no changes in serum enzyme activities were observed in 436. Chronic aggressive hepatitis was present in 14 of the 24 patients who developed phenolisatin-induced exacerbations. The remaining 10 patients had cirrhosis (three cases); chronic persistent hepatitis with and without cholestasis (four cases); chronic hepatitis with and without suspected aggression (two cases); and hepatic scarring with cirrhosis and ascites (one case). Bisacodyl did not cause any exacerbations of liver disease in the 200 patients to whom it was given. These findings suggest that phenolisatin-containing laxatives are responsible for almost 10% of the chronic liver disease in this group of patients. It is recommended that these laxatives be taken off the market in Germany.

3427 CONTROLLED TRIAL OF REPEATED HALOTHANE ANAESTHETICS IN PATIENTS WITH CARCINOMA OF THE UTERINE CERVIX TREATED WITH RADIUM. *(E.)* Trowell, J.; Peto, R.; Smith, A. C. (Radcliffe Infirm., Oxford, England). *Lancet* 1(7911):821-824, 1975.

The role of halothane in the etiology of liver damage was investigated in 39 women undergoing radium therapy for cervical carcinoma. Patients were randomized either to a halothane group exposed to halothane at each anesthetic (18 patients), or to a control group exposed to various other anesthetics using special halothane-free equipment (21). SGPT was measured in each patient the day before each anesthetic. Four patients in the halothane group developed SGPT levels over 100 IU/liter on admission for the third radium treatment (106-1350 IU/liter). Three had already had three previous exposures to halothane. None of the controls developed SGPT levels over 100 IU/liter, and no other function abnormalities were found in either group. It is concluded that liver damage is more common in cervical carcinoma patients after repeated halothane anesthetics than after other various common anesthetics.

3428 CONTROLLED PROSPECTIVE STUDY OF THE EFFECT ON LIVER FUNCTION OF MULTIPLE EXPOSURES TO HALOTHANE. *(E.)* Wright, R.; Chisholm, M.; Lloyd, B.; Edwards, J. C.; Eade, O. E.; Hawksley, M.; Moles, T. M.; Gardner, M. J. (Southamptom Univ. Hosp., England). *Lancet* 1(7911):817-821, 1975.

Liver function in patients repeatedly exposed to halothane was compared with that of controls given other anesthetics. Patients who had been given at least one anesthetic containing halothane within one yr, and presented again for anesthesia were randomly divided into two groups, one to be given halothane, and the other to be given any other anesthetic from halothane free equipment, except methoxyflurane. Premedication was with opiate and an antisialogogue; induction was with sodium thiopentone or alphadolone/alphaxalone and maintenance was with nitrous oxide and oxygen. Patients presenting for anesthesia more than once were elgible for reentry at random. Venous blood was taken immediately before and immediately after administration of anesthetic, and subsequently every 3-5 days for at least 2 weeks. Liver function tests included SGOT, SGPT, lactic dehydrogenase, total protein, albumin, and alkaline phosphatase. In the 160 patients studied, halothane (80 patients) and control groups (80 patients) were comparable regarding clinical features, blood transfusion history, and drug administration. Four in each group had raised preoperative transaminase levels and were excluded from further study. Two of these (both controls) had had repeated halothane anesthetics during the 40 days before the experiment. Of the remaining 76 halothane patients, 15 had abnormally high transaminase levels during the follow-up, compared with four of the 76 controls. Fourteen of the 15 halothane patients, and three of the four controls had less than four previous anesthetics. Raised SGOT levels were also most common in the halothane group that had had less than four previous anesthetics.

In these patients the time between the anesthetics was considerably shorter than in those who had had more than four previously. Six halothane patients had an SGOT peak over twice normal level; this occurred transiently during the second week. One patient had an SGOT level of 440 U and liver biopsy showed necrosis typical of hepatitis. No other biopsies were done. Of 43 halothane patients who had less than four previous anesthetics, 18 had increased SGPT levels compared to five of 28 controls. It is concluded that repeated halothane exposure may significantly raise SGOT levels, possibly because of hepatocytic necrosis.

3429 HEPATOTOXICITY IN PSORIATICS TREATED WITH LARGE DOSES OF METHOTREXATE. *(E.)* Tindall, J. P.; Krueger, R. T.; Callaway, J. L.; Murrell, Jr., T. W. (Duke Univ. Med. Cent., Durham, N.C.). *Cutis* 15(4):512-517, 1975.

Psoriasis patients (27) who had received a total dosage of over 5 g methotrexate were studied to determine hepatotoxicity. Percutaneous biopsy specimens were taken from the liver, stained with hematoxylin and eosin or Masson-trichome, and divided into four grades: 1)mild or no fatty infiltration, nuclear variability, and portal inflammation; 2)moderate to severe degrees of these same three conditions; 3) fibrosis with septum formation; and 4)cirrhosis. BSP was drawn 45 min after injection of a weight related amount. Folate determinations were made on serum separated immediately after blood drawing. Methotrexate was discontinued for at least three weeks prior to evaluation. Of 15 patients with between 5 and 8 g total dosage, eight had mild or no abnormalities, while five had moderate to severe abnormalities, and one had fibrosis. BSP values ranged from 3-8 and folate values ranged from less than 2 to 7. The average age of those with mild or no abnormalities was 37 yr and of those with moderate to severe abnormalities 56 yr. Of seven patients with over 8 g total dosage, two had no or mild abnormalities, one moderate to severe, and four fibrosis. BSP values were from 4-11 and folate 4-9. Four patients with over 5 g total dosage presented with cirrhosis. In these, BSP values were from 20-50. It is concluded that large doses of methotrexate are not always hepatotoxic, that damage may increase with age, and that biopsy is the best method for detecting liver damage.

3430 PRESENT-DAY STATE OF THE PROBLEM OF TOXIC HEPATITIS. *(Rus.)* Konchalovskaya, N. M.; Popova, T. V.; Byalko, N. K. (Inst. Ind. Hyg. Occup. Med., Moscow, USSR). *Gig. Tr. Prof. Zabol.* (12):10-13, 1974.

3431 THE VALUE OF ENZYMATIC TESTS IN DIAGNOSIS OF TOXIC HEPATOCELLULAR DAMAGE. *(Pol.)* Chrostowski, K.; Milewski, B. (CMKP, Warsaw, Poland). *Pol. Tyg. Lek.* 29(41):1737-1740, 1974.

3432 AN UNUSUAL CASE OF HEPATIC ACTINOMYCOSIS. *(Pol.)* Dolinski, J.; Kociatkiewicz, P.; Wiercinski, J. (Acad. Med., Wroclaw, Poland). *Wiad. Lek.* 27(15):1399-1402, 1974.

3433 ACUTE GONORRHEAL PERIHEPATITIS: LAPAROSCOPIC FINDINGS. *(Ger.)* Jenny, S.; Ammann, R.; Deyhle, P.; Schmid, J. (Canton. Hosp., Zurich, Switzerland). *Z. Gastroenterol.* 12(8): 623-624, 1974.

3434 FATAL HEPATIC NECROSIS FOLLOWING THERAPY WITH TRIMETHOPRIM-SULPHAMETOXAZOLE MIXTURE. *(It.)* Colucci, C. F.; Lo Cicero, M. (Maria della Pace Hosp., Naples, Italy). *Policlinico* 81(3):150-161, 1974.

3435 INJURIES TO THE LIVER. THERAPEUTIC PROBLEMS. VALUE OF ANGIOGRAPHY IN 50 CASES. *(Fr.)* Le Neel, J. C.; Leborgne, J.; Mitard, D.; Visset, J. (Reg. Hosp. Cent., Nantes, France). *J. Chir. (Paris)* 107(4):397-408, 1974.

3436 THE EFFECTS OF FLUORINATED ANESTHETICS ON THE LIVER AND KIDNEYS. *(E.)* Gottlieb, L. S.; Trey, C. (Boston City Hosp., Mass.). *Ann. Rev. Med.* 25:411-429, 1974.

3437 PARACETAMOL (ACETAMINOPHEN) AND THE LIVER. *(E.)* Anonymous. *Br. Med. J.* 1(5957):536-537, 1975.

3438 DECREASING MORBIDITY AFTER LIVER TRAUMA. *(E.)* Drezner, A. D.; Foster, J. H. (Hartford Hosp., Conn.). *Am. J. Surg.* 129(4):483-489, 1975.

3439 COMPLICATIONS OF LIVER RESECTION FOR TRAUMA. *(E.)* Heslop, J. H. (Univ. Otago Med. Sch., Dunedin, New Zealand). *Aust. NZ J. Surg.* 44(4):329-335, 1974.

See also, 3287, 3354, 3460, 3470, 3477, 3756, 3757.

3440 INCIDENCE AND NATURE OF CYTOPLASMIC HEPATITIS B ANTIGEN IN HEPATOCYTES. *(E.)* Gerber, M. A.; Hadziyannis, S.; Vernace, S.; Vissoulis, C. (VA Hosp., Bronx, N.Y.). *Lab. Invest.* 32(2):251-256, 1975.

Liver specimens from patients with various forms of hepatitis B antigen (HB Ag) positive or negative liver diseases were examined to determine the incidence and significance of ground-glass hepatocytes. Liver biopsy specimens (177) from 172 patients, and 6 liver necropsy specimens were fixed in formalin and stained with hematoxylin and eosin and Gomori's aldehyde fuchsin. In addition, 10 specimens were stained with orcein, 25 with methyl green-pyronin, and 25 were given the Fuelgen reaction. Direct fluorescent antibody staining for HB Ag was performed on frozen sections from 13 carriers, and on all HB Ag-seropositive patients with chronic hepatitis. Electron microscopy was performed on glutaraldehyde or formaldehyde fixed and osmium tetroxide post-fixed specimens from three carriers and eight HB Ag-seropositive patients with chronic hepatitis. Ground-glass hepatocytes were detected in 32 specimens in varying numbers. Aldehyde-fuchsin-positive ground-glass hepatocytes were found in all 14 HB Ag carriers and 16 of 60 HB Ag-seropositive patients with chronic hepatitis with or without cirrhosis. None were found in 24 patients with HB Ag-seronegative chronic hepatitis, 33 patients with HB Ag-seropositive or negative acute viral hepatitis, five patients with primary biliary cirrhosis, or 14 patients with drug-induced hepatitis with or without cirrhosis. In two HB Ag-seropositive patients, ground-glass hepatocytes were present in non-neoplastic tissue surrounding a hepatocellular carcinoma. Of 16 HB Ag-seropositive patients with chronic hepatitis and ground-glass hepatocytes, 14 had chronic aggressive hepatitis and two had chronic persistent hepatitis. Ground-glass hepatocytes were more numerous in carriers than in chronic hepatitis patients; in eight of 14 carriers over 5% were aldehyde-fuchsin positive, while only three of 16 chronic hepatitis patients were over 5% positive. Cytoplasmic fluorescence was detected in 13 carriers and in six of 11 HB-positive patients with chronic hepatitis, corresponding in percentage and distribution pattern to the aldehyde-fuchsin positive ground-glass hepatocytes. Electron microscopy showed numerous 20-30 nm tubular and circular structures surrounded by dilated endoplasmic reticulum in the hepatocytic cytoplasm of three carriers and one HB Ag-seropositive patient with chronic hepatitis. It is concluded that HB Ag is detectable by light microscopy as Gomori's aldehyde fuchsin-positive ground-glass appearance of hepatocytic cytoplasm.

3441 ULTRASTRUCTURAL STUDY OF CYTOPLASMIC INCLUSIONS IN CASES OF VIRAL HEPATITIS AND HEPATOMAS. *(E.)* Scotto, J.; Homberg, J. C.; Stralin, H.; Caroli, J. (INSERM, St. Antoine Hosp., Paris, France). *Pathol. Eur.* 9(3):211-216, 1974.

Liver biopsies taken from 32 severe cases of viral hepatitis, 2 cases of chronic agressive hepatitis, and 2 cases of hepatoma, all at least 24 hr before death, showed hepatocellular cytoplasmic inclusions. Specimens were examined by electron microscopy after fixation in glutaraldehyde and/or osmium tetroxide, and by light microscopy after staining in hematoxylin and eosin. Cytoplasmic inclusions with generally round or oval shapes, and no limiting membranes were observed in many of the hepatocytes from the cases of hepatitis. The structure of these inclusions was homogeneous, granular and fibrillar in varying ratio, with the granular component frequently dominant. Mallory bodies, which the inclusions resemble, in contrast have more irregular outlines, commonly are serpiginous in form, and are largely fibrillar with longer and broader fibrils (140-165 Å). The fibrils of the inclusions were short and never thicker than 80 Å, and the granules varied from 15-200 Å. Light microscopy showed the inclusions to be faintly gray, rather than brilliantly eosinophilic like Mallory bodies. The number of inclusions varied from cell to cell without apparent relation to the lobule. In the hepatomas, the inclusions were seen in poorly differentiated tumor cells not showing fatty infiltration. It is concluded that these inclusions are not Mallory bodies, and may represent stored viral material.

3442 TOLERANCE TO HEPATITIS B ANTIGEN: A HYPOTHESIS FOR ITS TERMINATION WITH 'IMMUNE-RNA'. *(E.)* Vyas, G. N.; Ibrahim, A. B.; Rao, K. R.; Schmid, R. (Sch. Med., Univ. California, San Francisco). *Life Sci.* 15(2):261-266, 1974.

An hypothesis is postulated based mainly on previously published reports, on the mechanism of acquiring tolerance to hepatitis B surface antigen (HB_sAg) and a possible approach for terminating this tolerance is proposed. Immunologic tolerance to HB_sAg, evidenced by a lack of specific cellular and humoral immune response to HB_sAg, produces a chronic carrier state which serves as an epidemiologic reservoir for the transmission of viral hepatitis type B. In patients with Down's syndrome, uremia, leprosy, renal transplants, chronic active hepatitis, leukemias, and other malignancies, HB_sAg may persist in the plasma for extended periods of time. This persistence is ascribed to genetically determined or acquired impairment of cell-mediated immunity. In apparently healthy carriers the mechanisms of HB_sAg formation and persistence in the plasma are obscure. The observation of neonatal onset of the chronic carrier state suggests that the fetus may acquire immunologic tolerance to HB_sAg as a result of exposure to HB_sAg during a critical period of its intrauterine life. Slow viral infection with lymphocytic choriomeningitis virus in mice provides an analogous model suggesting immunologic tolerance mediated by T-cells. It is proposed that cell-mediated immunity may be transferred to tolerant individuals with "immunoinformational" RNA derived from leukocytes of persons with demonstrable cell-

mediated immunity. Adoptive transfer of cell-mediated immunity with the transfer factor has been unsuccessful in an asymptomatic chronic carrier; however, maternal transfer factor has been reported to cause a 95% reduction of HB_SAg over a 4-month period in a patient with neonatally acquired hepatitis B infection. The effectiveness of this immunoinformational RNA for transfer of cell-mediated immunity to chronic carriers could be assessed *in vitro* by leukocyte migration inhibition techniques and in HB_SAg-positive chimpanzees *in vivo*. If these *in vitro* and *in vivo* studies should demonstrate the efficacy and safety of the proposed procedure, it is suggested that immunoinformational RNA be tested for terminating the chronic carrier state in man.

3443 DELAYED HYPERSENSITIVITY IN HEPATITIS B: CLINICAL CORRELATES OF IN VITRO PRODUCTION OF MIGRATION INHIBITION FACTOR. *(E.)* Irwin, Jr., G. R.; Hierholzer, Jr., W. J.; Cimis, R.; McCollum, R. W. (Yale Univ. Sch. Med., New Haven, Conn.). *J. Infect. Dis.* 130(6):580-587, 1974.

Delayed hypersensitivity to hepatitis B surface antigen (HB_SAg) in patients with disease from the clinical spectrum of hepatitis and in controls was examined by an indirect assay of macrophage migration inhibitory factor (MIF). Patients with HB_SAg-positive acute hepatitis and HB_SAg-positive or -negative persistent hepatitis produced MIF. MIF activity was not detected in patients who were receiving steroids or in pregnant patients with acute HB_SAg-positive hepatitis. Patients with a documented history of HB_SAg-positive mild hepatitis (6 months to 2 yr previous) but without continuing clinical or laboratory evidence of liver disease did not demonstrate MIF. Patients with acute hepatitis epidemiologically related to ingestion of shellfish and without a history of drug use or exposure to blood products did not produce MIF. Individuals with antibody to HB_SAg detectable by hemagglutination and/or precipitation in agar gel did not make MIF, nor did antibody-negative normal controls. In one individual, mistakenly given a unit of HB_SAg-positive blood, MIF was not detectable on 2 occasions before the appearance of clinical illness. During and shortly after clinical illness, MIF was present; it was undetectable again 72 days after disappearance of abnormal liver function and clinical signs and symptoms. Results from all categories of patients were reproducible; however, in some cases the degree of inhibition in the second test was lower than in the original test. Thus the ability to detect MIF seemed dependent on the presence of clinical illness at the time of the assay.

3444 NEONATAL HEPATITIS TYPE B--A THREE YEAR FOLLOW-UP. *(E.)* Dahlquist, E.; Nordenfelt, E. (Dep. Infect. Dis., Univ. Lund, Sweden). *Scand. J. Infect. Dis.* 6(4):305-308, 1974.

Counterelectrophoresis and immunodiffusion techniques were used to detect hepatitis B antigen (HB Ag) in 2 cases of newborn children of mothers with hepatitis during pregnancy. The first case was a 31-yr-old woman who developed acute hepatitis during the eighth month of pregnancy. HB Ag subtype *y* was detected in her serum. About a month later she gave birth to a premature but normal female infant. HB Ag subtype *y* was not detected in the infant's serum until about 2 months later. A liver biopsy at 2.5 yr disclosed chronic persistent hepatitis, but she has had normal development and good general condition. The second case was a 40-yr-old woman who developed acute hepatitis in the seventh month of pregnancy. HB Ag subtype *y* was again found in the serum. She gave birth to a normal male infant who became positive for the antigen 33 days after delivery. A liver biopsy about 10 months later disclosed chronic hepatitis, but a second biopsy a month later showed no sign of disease. Although long term effects of neonatal hepatitis are unknown, prognosis appears to be good.

3445 THE EPIDEMIOLOGICAL IMPORTANCE OF 'ay' AND 'ad' SUBTYPES OF THE HB-Ag. *(E.)* Pons-Romero, F.; Heathcote, J.; Sherlock, S. (R. Free Hosp., London, England). *Gut* 15(9):733-736, 1974.

The distribution of the subtypes *ay* and *ad* was assessed in 159 hepatitis B antigen (HB Ag) positive subjects with a variety of associated hepatic conditions. Sixty-nine patients were diagnosed as having acute hepatitis, 17 were healthy carriers, 41 had chronic aggressive hepatitis, 27 had chronic persistent hepatitis, and 5 had primary liver cell cancer. The subjects fell into 1 of 4 geographical groups: 71 came from northern Europe, 57 from Mediterranean countries, 8 from the Middle East, and the remaining 16 from a variety of countries not in these regions. All serum samples were set up against *y* and *d* antisera and tested by counterimmunoelectrophoresis. All of the HB Ag-positive samples could be subtyped either *ay* or *ad*. When the subtyping results from all 159 subjects were considered, there was no significant dishomogeneity between *ay*:*ad* proportions in the various diagnostic groups. However, when compared according to geographic regions, the ratio *ay* to *ad* was significantly greater in the Mediterranean subjects. Differences in the distribution of the two subtypes were also seen within each diagnostic group when its members from northern Europe and the Mediterranean areas were compared. Among the patients with acute hepatitis, this difference in distribution of the two subtypes did not emerge until the patients were separated as to where they were thought to have contracted hepatitis. In nine households where intra-household, non-parenteral transmission of the HB Ag was suspected, the subtype was the same within each household; five were all *ay* and four were all *ad* in type. These results demonstrate that both subtypes may be associated with all forms of HB Ag-positive acute and chronic liver disease and present in healthy carriers. However, the geographical origin of the HB Ag-positive person, and possibly the route of infection with the HB Ag, may influence the subtype findings in any one area. It is suggested that subtype *ay* predominates in

Mediterranean areas while *ad* predominates in northern Europe. It is suggested therefore that infection with a particular subtype of the hepatitis B virus is associated with epidemiological factors and cannot be related to any particular form of hepatic pathology.

3446 HYBRIDISATION OF DANE PARTICLE DNA WITH THE FREE PLASMA DNA OF HEPATITIS CARRIERS. *(E.)* Hung, P. P.; Mao, J. C. H.; Ling, C. M.; Overby, L. R. (Dep. Virol., Abbott Lab., North Chicago, Ill.). *Nature* 253(5492):571-572, 1975.

Plasma from commercial donors were screened for Hepatitis B surface antigen (HB_sAg) by radioimmunoassay. Positive specimens were then screened for free DNA by dialysis of 50 ml plasma against Tris buffer containing .01% diethylpyrocarbonate. Cesium chloride was added to the dialyzed plasma to an average density of 1.05 and the solution was centrifuged for 67 hr at 3500 rpm. Synthesis and isolation of ^3H-thymidine from Dane particles was also carried out, and this labeled DNA was hybridized with the free DNA isolated from the plasma. Both DNA samples were denatured separately with NaOH, neutralized with HCl, and incubated together in 1 x SSC for 4 hr at 68 C. Unhybridized DNA was digested, and calf thumus DNA was added as a carrier. Radioactivity was determined by scintillation spectrometer. The free isolated DNA possessed homology with the labeled Dane particle DNA, but not with samples of DNA from human liver, WI-38 cells, salmon sperm, or calf thymus. Of 21 HB_sAg-positive plasma samples, all had detectable free DNA of which five randomly selected samples were hybridizable with Dane particle DNA. In contrast, 19 of 21 HB_sAg-negative samples had no detectable free DNA. The remaining 2 had free DNA hybridizable with Dane particle DNA. The length of the free plasma was estimated at 2-3 μm, longer than that of the Dane particle genome, equivalent to a molecular weight of 4×10^6 to 5×10^6. The results suggest the possibility of using molecular hybridization with immunological techniques to determine potential blood plasma infectivity.

3447 HEPATITIS B ANTIGEN AND ANTIBODY IN MATERNAL BLOOD, CORD BLOOD, AND AMNIOTIC FLUID. *(E.)* Papaevangelou, G.; Kremastinou, T.; Prevedourakis, C.; Kaskarelis, D. (Dep. Hyg. Epidemiol., Univ. Athens, Greece). *Arch. Dis. Child.* 49(12):936-939, 1974.

Transmission of hepatitis B virus from carrier mothers to their newborns was studied using hepatitis B antigen (HB Ag) and antibody (HB Ab) in maternal blood, umbilical cord blood, and amniotic fluid. A random sample of 428 women had maternal and umbilical cord bloods drawn. Sixty-nine also had amniotic fluid drawn at delivery and concentrated 10 times. HB Ag was detected by counter-immunoelectrophoresis. Passive hemagglutination assay was used to screen for HB Ab in 173 mothers. HB Ag was not detected in the umbilical cord blood of the antigen-negative mothers, but was shown to be in the umbilical cord blood of two of the 14 newborns of permanent antigen carrier mothers. The antigen was not in blood samples drawn 3 months after delivery of the infants from the carrier mothers, or from the two infants who had positive cord blood. HB Ab was absent in the umbilical blood of one of 38 HB Ab-positive mothers, and was not found in maternal or umbilical blood or amniotic fluid of any of the HB Ag-positive cases. HB Ab was also absent from the amniotic fluid of 59 negative mothers and three of 10 positive mothers. HB Ab titers were significantly lower in amniotic fluid than in maternal or umbilical blood. There was not correlation between HB Ab titers of umbilical blood and amniotic fluid. It is concluded that transplacental transmission from carriers is not uncommon, occurs through exposure of the fetus to the virions, and that antibody to the hepatitis b virus easily crosses the placental barrier.

3448 THE SIGNIFICANCE OF INVOLVEMENT OF THE INTRAHEPATIC BILE DUCTS IN THE GENESIS OF JAUNDICE AND CHOLESTASIS IN VIRAL HEPATITIS. *(Ger.)* Bluger, A. F.; Kartasova, O. J.; Maksimova, L. A. (Med. Inst., Riga, USSR). *Dtsch. Z. Verdau. Stoffwechselkr.* 34(1):9-16, 1974.

Clinical symptoms and the findings from liver biopsies were compared in 260 patients with acute viral hepatitis: 70 had the anicteric form and 190 were jaundiced. Signs of cholestasis (pruritus and increased serum alkaline phosphatase, cholesterol, β-lipoprotein, and copper levels) were present in 43 of the 90 patients with jaundice. Changes in intrahepatic bile ducts were detected in 73% of all patients, including 87% of those with jaundice and in 37% of those with anicteric hepatitis. These changes consisted of epithelial abnormalities (cytoplasmic swelling and granulation, nuclear pyknosis, and karyolysis) and desquamation of epithelial cells into the intrahepatic bile ducts; a pronounced mesenchymal reaction; inclusions of neutral lipids and glycoproteins in the cytoplasm of bile duct cells; an increased alkaline phosphatase activity in the walls of the bile ducts; and cytochrome oxidase activity in periductal cell infiltrates. Under the electron microscope, shrinking of the nuclei, vacuolization of bile duct cells, and many fragments of desquamated cells in the lumen were evident. These forms of cholangitis are characterized as (1) catarrhal, (2) obstructive, or (3) destructive. Only catarrhal cholangitis was present in 93% of those with cholestatic hepatitis. The high incidence of obstructive cholangitis in these patients suggests that bile duct lesions interfere with normal production of bile and prevent bile flow in hepatitis. Obstructive cholangitis was also found in 67% of all jaundiced patients, but destructive cholangitis occurred in only one patient with cholestasis. Mathematical analysis of the relation between bile duct lesions and the increase in bilirubin levels showed a close correlation between intact bile ducts or catarrhal cholangitis and bilirubin levels of 5 mg/100 ml or less and a direct correlation between obstructive cholangitis and bilirubin levels of 5 to 10 mg/100 ml or over 10 mg/100 ml. Obstructive cholangitis occurred in 55% of patients with cytoly-

sis syndrome (increased SGOT and iron levels and abnormal thymol turbidity tests). Cytolysis was not related to bile duct lesions, but cholestasis, either alone or accompanied by cytolysis syndrome was correlated with obstructive cholangitis.

3449 SUBTYPES OF HEPATITIS B ANTIGEN AMONG PATIENTS AND SYMPTOMLESS CARRIERS. *(E.)* Green, H. T.; Turner, G. C. (Fazakerley Hosp., Liverpool, England). *J. Hyg. (Camb.)* 74(1):123-132, 1974.

The relationship between the forms of hepatitis B infection and the *ad*, *ay* and *a* subtypes associated with them were studied in 255 subjects. Of these, 127 had chronic liver disease or were symptomless hepatitis B antigen (HB Ag) carriers, two were infants of HB Ag-positive mothers who became positive at about 2 months of age, and one was an adult with transient antigenemia but no evidence of hepatitis. HB Ag-positive sera were identified by immunoelectrophoresis and subtyped by immunodiffusion using hepatitis B antibody positive sera that gave spurs characteristics of partial identity reactions between preciptin lines with reference to *ad* and *ay* HB Ag-positive sera. The 127 acute hepatitis patients fell into four categories: blood transfusion; illegal drug injections or social intercourse with addicts; miscellaneous parenteral exposure; and contact with HB Ag-positive patients undergoing hemodialysis. Subtypes were found with equal frequency in those with no parenteral exposure and those with blood transfusions, but subtype *ay* was predominant in those with illegal drug injections (100%), social contact with addicts (91%), and such miscellaneous parenteral exposure as tattooing, injections, or accident in medical or dental practice (80%). All hemodialysis cases were *ay* but were all from the same hemodialysis unit. Of 34 post-transfusion cases, 2 groups received their transfusions in Liverpool and North Wales and had subtype *ad* in 64% and 60%, resp. A third group received blood elsewhere, and 70% of them had subtype *ay*. The chronic hepatitis patients fell into 3 categories: symptomless carriers of HB Ag; patients with chronic liver or other diseases; and patients with chronic renal failure on hemodialysis. Of the symptomless carriers, 78% were *ad*, 21% *ay* and 1% *a*. The patients with chronic liver diseases were 55% *ad* and 45% *ay*, and those with non-liver diseases were 71% *ad* and 29% *ay*. All the hemodialysis patients were subtype *ay* but all were in 1 hemodialysis unit. The results confirm previous reports that subtype *ad* is associated largely with chronic or symptomless infection, while subtype *ay* is associated with acute hepatitis.

3450 CONTENT OF TOTAL SERUM HEXOSES BOUND WITH PROTEINS AND THEIR URINARY EXCRETION IN PATIENTS WITH VIRAL HEPATITIS (BOTKIN'S DISEASE). *(Rus.)* Fedianin, Iu. P.; Rabinovich, P. D.; Vaistukh, S. I. (Chita Med. Inst., USSR). *Ter. Arkh.* 46(4):63-67, 1974.

The total content of serum hexoses and their urinary excretion was investigated in 67 patients with acute viral hepatitis. The total serum content was 186.0 mg% at the height of the disease; 168.0 mg% after the disappearance of jaundice; and 184.0 mg% during convalescence. The urinary excretion of hexoses in the patients at the height of the disease was nearly twice that of the healthy people (1.066 mg/day and 548.2 mg/day, resp.). During convalescence, the urinary excretion of hexoses was lower (734.0 mg/day) than it was at the height of the disease, but exceeded that of the healthy subjects. The findings also indicate that urinary excretion of hexoses bound with biopolymers and their concentration in the urine of patients was more than 1.5 times higher at the height of the disease than in the healthy people (84.3 mg and 15.7 mg%; 49.5 mg and 9.1 mg%, resp.). During the convalescent period these indices returned to normal (62.8 mg and 10.6 mg%). It is suggested that in patients with acute viral hepatitis, the concentration of serum hexoses bound with proteins increases, while their urinary excretion rises at all stages of the disease. During the convalescent period, the enzyme hexose content and their urinary excretion remain elevated, while the indices of metabolic pigment and proteins return to normal. The total content of hexoses bound with the proteins may be indicative of the severity of the destructive changes in the acute stage of the disease and of the degree of the regenerative processes in the liver during convalescence.

3451 DETECTION AND PATHOGENIC ROLE OF CIRCULATING IMMUNE COMPLEXES INVOLVING HEPATITIS B SURFACE ANTIGEN. *(E.)* Trepo, V. C.; Prince, A. M. (New York Blood Cent., N.Y.). *Z. Gastroenterol.* 13: 278-281, 1975.

The role of circulating immune complexes involving the hepatitis B surface antigen (HB_sAg) in the pathogenesis of liver and kidney disease was investigated. Such circulating complexes have been demonstrated in patients positive for HB_sAg or anti-HB_s. SGPT levels were compared in 60 asymptomatic chronic HB_sAg carriers with coexisting anti-HB_s and 60 HB_sAg carriers without detectable anti-HB_s. The SGPT values did not differ significantly between the two groups, and assessment of hepatic damage by liver biopsy in 70 HB_sAg carriers confirmed the lack of correlation between anti HB_s and evidence of liver disease. When 300 ml of high titer anti-HB_s-containing plasma from a hyperimmune chimpanzee was infused into a healthy chronic HB_sAg carrier animal, there was no significant rise in the animal's SGPT values. Thus, circulating HB_sAg/Ab complexes are probably not particularly pathogenic for the liver, although they presumably are involved in the pathogenesis of various extrahepatic manifestations which may be associated with HB_s antigenemia (e.g., vasculitis, polyarthritis, glomerulonephritis). The previously observed dissociation between usually mild anicteric hepatitis and severe lesions of vasculitis and/or glomerulonephritis in patients with periarteritis nodosa or glomerulonephritis associated with persisting HB_s antigenemia suggest that the hepatic and extrahepatic lesions of hepatitis B are

probably mediated by two different immunopathogenic mechanisms; circulating HB_sAg complexes are probably only responsible for the latter.

3452 CLINICO-PATHOLOGICAL STUDIES OF THE LIVER IN ASYMPTOMATIC CARRIERS OF AUSTRALIA ANTIGEN (HBAg). *(E.)* Ichida, F.; Sasaki, H.; Sekine, T.; Inagaki, T.; (Sch. Med., Niigata Univ., Japan). *Acta Hepatogastroenterol. (Stuttg.)* 22(1):13-21, 1975.

Blood donors (55 males, 1 female) who were carriers of the Australia antigen (HB_sAg) and had normal SGPT values were examined clinically, immunologically, and histologically. Among these subjects, the SGPT was abnormal in 14.5% of the cases, the SGOT was abnormal in 9%, the serum bilirubins were abnormal in 12.2%, the serum alkaline phosphatase level was abnormal in 24.5%, the tolbutamide tolerance test in 4.4%, the ZTT was abnormal in 2.2%, the γ-globulin was abnormal in 21.2%, and the indocyanine green retention was abnormal in 25.6%. Anti-HB_s was negative in all subjects and the rate of lymphocytic blastogenesis in the peripheral blood was low in seven of 19 patients. The migration inhibitory factor test determined by the addition of purified HB_sAg revealed that 17 subjects, excluding one with a histologic picture of acute hepatitis, were not susceptible to HB_sAg. Histologic examinations of liver biopsies in 20 subjects showed nonspecific reactions in seven, acute viral hepatitis in one, and fatty liver in two. Acute viral hepatitis accompanied by very slight inflammatory reactions in the lobules was found in eight subjects, and pleomorphism was noted in the hepatocytes of eight. It is probable that the low humoral and cell-mediated antibody titers to HB_sAg in asymptomatic carriers of HB_sAg are involved in the mechanism of continuous HB_sAg positivity.

3453 HEPATITIS B: A NEW VACCINE READY FOR HUMAN TESTING. *(E.)* Maugh, II, T. H. (no affil.). *Science* 188(4184):137-138, 1975.

Viral antigens isolated from human carriers of hepatitis B have been used to prepare a vaccine against this disease. Available evidence indicated that the nucleic acid core of the presumed hepatitis virus replicates in the nucleus of liver cells and migrates to the cytoplasm, where it is sheathed in the protein coat of the hepatitis B surface antigen (HB_sAG or Australian antigen). Early work showed that injections of blood serum from chronic human carriers of HB_sAg protected 70% of a group of children who were later exposed to hepatitis. The new vaccine was prepared by separation of the antigen from viral particles in the blood by centrifugation, purification of the antigen by centrifugation or a chemical procedure, and treatment of the antigen with formalin to inactivate any remaining virus particles. Of four chimpanzees given the vaccine, all developed antibodies to HB_sAg and none developed hepatitis; one animal given a vaccine which had not been exposed to formalin did develop hepatitis. Six months later, all animals were given an infectious dose of hepatitis B virus subtype *ayw*. None of the animals given vaccine prepared from subtype *ayw* developed hepatitis. Although one animal given vaccine prepared from subtype *adr* did become infected, it developed none of the signs of the disease. The next step will be limited testing in humans to ensure that the vaccine is safe. If it is found safe and effective in humans, it can be used to protect individuals who are likely to come into contact with the hepatitis virus.

3454 ACUTE VIRAL HEPATITIS: FACTORS POSSIBLY PREDICTING CHRONIC LIVER DISEASE. *(E.)* Dietrichson, O.; Juhl, E.; Christoffersen, P.; Elling, P.; Faber, V.; Iversen, K.; Nielsen, J. O.; Petersen, P.; Poulsen, H. (Kommunehosp., Copenhagen, Denmark). *Acta Pathol. Microbiol. Scand.* [*A*] 83(1):183-188, 1975.

Clinical, biochemical, immunological, and morphological variables recorded at first hospital admission were compared in 74 patients with uncomplicated acute viral hepatitis and in 28 patients who subsequently developed chronic liver disease. Clinically, the only difference between the two groups was a higher percentage of drug addicts in the group with subsequent chronic liver disease. Although there were some biochemical differences between the two groups, only the highest registered bilirubin values showed a significant difference; they were highest in the group with subsequent morphological normalization. The group that subsequently developed chronic liver disease had significantly higher maximal γ-globulin values, a significantly higher incidence of antinuclear antibodies and smooth muscle antibodies, a significantly higher incidence of Australia antigen subtype Y, and a nonsignificantly higher incidence of Australia antigens of all subtypes. The group which subsequently developed chronic liver disease also showed a higher incidence of defect limiting plate, piecemeal necrosis, and pronounced plasma cell infiltration in the portal tracts on biopsy. The results suggest that the immunological and more detailed morphological changes which distinguish the two groups at the start of acute viral hepatitis are, to some extent, the same as those which are of importance in predicting the prognosis of chronic hepatitis.

3455 HEPATITIS B VIRUS ANTIGEN QUANTITATION BY RADIOIMMUNOASSAY (RIA) IN VIRAL HEPATITIS AND IN CHRONIC LIVER DISEASE. *(E.)* De Ritis, F.; Gravina, E.; Squame, G. (2nd Med. Sch., Univ. Naples, Italy). *Acta Hepatogastroenterol. (Stuttg.)* 22(1): 4-13, 1975.

Immunological techniques and a solid-phase radioimmunoassay were used to study the incidence of the hepatitis B viral antigen (HB Ag) in 70 patients with

viral hepatitis, 13 patients with chronic active hepatitis, and 20 patients with cirrhosis. As demonstrated by radioimmunoassay, 90% of the patients with post-transfusion hepatitis, 88% of those with acute viral hepatitis, and 35% of those with cirrhosis were positive for HB Ag. In each group, agar gel diffusion, counter immunoelectrophoresis, and complement fixation tests showed a lower percentage of HB Ag-positive cases. The degree of antigenemia was determined using a linear plot of the percent of [^{125}I] HB Ag count bound *versus* increasing dilutions of HB Ag-positive controls. The resulting dose-response curves were used to follow-up 15 patients suffering from acute hepatitis. In the first week, circulating levels of HB Ag were distributed into three classes of values; this distinction was less evident in the following weeks. The concentrations of HB Ag became progressively lower with time, reaching nondetectable levels by the eighth week. Radioimmunoquantitation of HB Ag in the sera of patients with chronic active hepatitis showed a wide range of antigenemia (17-5100 ng/Eq/ml *ad*) in 13 patients. Use of a dose-response standard curve also improved the sensitivity of the radioimmunoassay technique in patients with cirrhosis. The results indicate that radioimmunoassay is more sensitive than other immunological methods for the detection of HB Ag in acute and chronic hepatitis.

3456 IS THERE A RISK OF TRANSMITTING HEPATITIS BY GASTRODUODENOSCOPY? *(Ger.)* Massarat, S.; Urban, M.; Schiff, W. (Med. Polyclin., Univ. Marburg/Lahn, Germany). *Dtsch. Med. Wochenschr.* 100(2): 42-45, 1975.

The risk of transmitting virus-B hepatitis by gastroduodenoscopy was studied in 211 patients who underwent gastroduodenoscopy by using the same endoscope for all patients. After use, the endoscope was sterilized by a routine method, including washing with tap water, immersion in a disinfectant solution for 20-30 min, and final cleaning with 70% alcohol. Five patients had been carriers of Australia antigen (HB_s Ag) before gastroduodenoscopy. The follow-up examinations carried out 2 and 4 months after gastroduodenoscopy revealed HB_sAg in the same five patients, and in two additional patients who, however, had been subjected to this examination before the HB_sAg carriers. One of the two new HB_sAg-positive patients had liver cirrhosis; multiple infusions of albumin had been carried out in the other after gastroscopy. In this case, infusion may have been the cause of HB_sAg transsion. No proven case of hepatitis transmission occurred in this group of patients. The findings indicate low probability of hepatitis transmission at gastroduodenoscopy, and no need for preliminary HB_s Ag tests prior to gastroscopy.

3457 SUBACUTE NECROTIZING HEPATITIS: DIAGNOSIS, COURSE, AND PROGNOSIS. *(Ger.)* Lammli, J.; Vetter, D.; Knoblauch, M.; Schmid, M. (Waid Munic. Hosp., Zurich, Switzerland). *Helv. Med. Acta.* 37(5/6); 403, 1974.

The pathogenesis, symptomatology, therapy, and prognosis of subacute necrotizing hepatitis in 18 female and 4 male patients are described. Serious and protracted jaundice, prolonged impairment of the general health status with asthenia, nausea, and anorexia were the principal symptoms of the disease. Hepatomegaly and splenomegaly were detected in 2/3 and in 1/3 of all cases, resp. Portosystemic encephalopathy, ascites, and edema were frequent, and the bilirubin levels reached an average maximum of 21 mg% in 4.5 weeks. The γ-globulin levels sometimes reached values commonly observed in chronic aggressive hepatitis. Almost 50% of all patients were Australia antigen-positive. The causative agent was determined to be oxyphenisatin-base laxatives in two cases. Organ-unspecific antibodies without prognostic significance were temporarily present in 1/3 of all patients. Three patients died in hepatic coma after 5 weeks. Follow-up examinations after 18 months revealed full recovery in five cases, scarred liver in five, chronic aggressive hepatitis in four, and chronic persistent hepatitis in three cases. Corticosteroid therapy was successful in 13 patients.

3458 CHANGES IN THE GAS COMPOSITION OF THE BLOOD DURING VIRAL HEPATITIS. *(Rus.)* Metreveli, K. M. (Repub. Clin. Infect. Dis., Min. Health Georgian SSR, USSR). *Soobshch. Akad. Nauk Gruz. SSR* 76(2):457-460, 1974.

3459 CHANGES OF THE ACTIVITY RATIO OF LACTATE DEHYDROGENASE ISOENZYMES LDG_5/LDG_4 IN LIVER DISEASES. *(Rus.)* Tsarapkin, M. I. (Reg. Mil. Hosp., Odessa, USSR). *Vrach. Delo* (11):66-68, 1974.

3460 THE MORPHOLOGICAL PATTERN OF VIRAL AND TOXIC LIVER INJURY. *(Ger.)* Vido, I. (Med. Coll., Hannover, Germany). *Z. Gastroenterol.* 12(8):624, 1974.

3461 WATER-BORNE OUTBREAK OF INFECTIOUS HEPATITIS. *(Rus.)* Nikiforov, V. N.; Paltseva, T. F.; Skavinskii, Iu. V.; Gulman, L. A.; Shilenok, I. G.; Starosotskaia, T. Ia. (Cent. Inst. Postgrad. Med., Moscow, USSR). *Sov. Med.* (9):101-105, 1974.

3462 CLINICAL FEATURES OF VIRAL HEPATITIS IN PATIENTS WITH PEPTIC ULCER. *(Rus.)* Krylova, O. M.; (Leningrad Med. Inst. Sanit. Hyg., USSR). *Sov. Med.* (8):153-154, 1974.

3463 LIVER COMA CAUSED BY FULMINATING HEPATITIS. *(It.)* Berengo, A. (Inst. Infect. Dis., Univ. Milan, Italy). *Terapia (Milano)* 59(426):43-52, 1974.

3464 STUDIES ON THE PREVALENCE OF VIRAL HEPATITIS AMONG PERSONNEL WORKING WITH HUMAN BLOOD. *(Rus.)* Draganov, P.; Teokharova, M.; Astrukova, S.; Losev, B.; Mineva, E.; Peeva, Z. (Med. Acad., Sofia, Bulgaria). *Vrach. Delo* (12):116-120, 1974.

3465 THE DETECTION OF HEPATITIS B ANTIGEN IN RELATION TO HEPATIC INDICATOR ENZYMES IN PATIENTS WITH VIRAL HEPATITIS. *(Ger.)* Boron, P.; Sokolewicz Bobrowska, E.; Dzikowski, M. (Med. Acad., Bialystok, Poland). *Z. Gesamte Inn. Med.* 29(24):997-1040, 1974.

3466 FOLLOW-UP OF HEPATITIS B ANTIGEN DURING AND AFTER ACUTE VIRUS HEPATITIS IN 1964-1972. *(Ger.)* Alexander, M.; Scholz, V.; Wenzel, H. (Dep. Infect. Dis., Free Univ. Berlin, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:977-979, 1973.

3467 PREVALENCE OF HEPATITIS B ANTIBODY IN BLOOD DONORS IN SOUTHWEST GERMANY. *(Ger.)* Frosner, G. G.; Sugg, U.; Schneider, W.; Gerth, H. J. (Hyg. Inst., Univ. Tubingen, Germany). *Munch. Med. Wochenschr* 117(3):81-82, 1975.

3468 GAMMA GLOBULIN PROPHYLAXIS OF INFECTIOUS HEPATITIS. *(Ger.)* Schiiz, R.; Rollinghoff, W. (Paul Lechler Hosp., Tubingen, Germany). *Munch. Med. Wochenschr.* 117(3):77-80, 1975.

3469 CURRENT CONCEPTS OF VIRAL HEPATITIS AND A PEEK INTO THE FUTURE. *(E.)* Koff, R. S. (Boston VA Hosp., Mass.). *Yale J. Biol. Med.* 47(4): 252-259, 1974.

3470 CLINICAL PROBLEMS OF TUBERCULOSTATIC THERAPY AND ACUTE VIRUS HEPATITIS. *(E.)* Schondorf, T.; Leinweber, B. (Cent. Intern. Med., Justus Liebig Univ., Giessen, Germany). *Acta Hepatogastroenterol. (Stuttg.)* 21(6):411-418, 1974.

3471 SERUM HEPATITIS (SH) ANTIGEN AMONGST PATIENTS WITH LIVER DISEASES AND VOLUNTARY BLOOD DONORS - A PROSPECTIVE STUDY. *(E.)* Pal, S. R.; Dutta, D. V.; Choudhury, S.; Jolly, J. G.; Deodhar, S. D.; Samant, A. K. S.; Chitkara, N. L.; Chuttani, P. N. (Post-Grad. Inst. Med. Educ. Res., Chandigarh, India). *Indian J. Med. Res.* 61(12):1784-1799, 1973.

3472 ABNORMALITY OF THE STRUCTURE AND COMPOSITION OF PLASMA LIPOPROTEINS (HDL) DURING DIFFERENT TYPES OF HEPATITIS. *(E.)* Hartmann, L.; Ollier, M. P.; Fiessinger, J. N.; Nebut, M. (Chem. Clin., Paris, France). *Biomedicine* 21(12):480-485, 1974.

3473 FULMINANT HEPATITIS ASSOCIATED WITH ACQUIRED DEFECT IN HUMORAL IMMUNITY. *(E.)* Greally, J.; Dillon, J.; Mayne, B. (Meath Hosp., Dublin, Ireland). *Ir. J. Med. Sci.* 143(6):350-355, 1974.

3474 EPIDEMIOLOGY OF HEPATITIS B ANTIGENEMIA IN AN INSTITUTION FOR MENTALLY RETARDED. *(E.)* Tevaluoto-Aarnio, M. (Rinnekoti Inst. Ment. Retard., Univ. Helsinki, Finland). *Scand. J. Infect. Dis.* 6(4):309-313, 1974.

3475 HEPATIC CIRCULATION DURING AND AFTER INFECTIOUS HEPATITIS. *(E.)* Lundbergh, P. (Rolagstull Hosp., Stockholm, Sweden). *Scand. J. Infect. Dis.* 6(4):297-304, 1974.

3476 HEPATITIS-B-ANTIGEN AND CORRESPONDING ANTIBODIES AFTER MULTIPLE BLOOD TRANSFUSIONS. *(Ger.)* Mullis, C. H.; Grob, P. J. (Dep. Intern. Med., Univ. Zurich, Switzerland). *Schweiz. Med. Wochenschr.* 104(30):1053-1060, 1974.

3477 ARTIFICIAL LIVER SUPPORT IN FULMINANT HEPATIC FAILURE. *(E.)* Williams, R. (King's Coll. Hosp. Med. Sch., London, England). *Bull. NY Acad. Med.* 51(4):508-518, 1975.

3478 PATHOLOGY OF VIRAL HEPATITIS AND ITS SEQUELAE. *(E.)* Thaler, H. (Wilhelm Hosp., Vienna, Austria). *Bull. NY Acad. Med.* 51(4):481-490, 1975.

3479 IMMUNOLOGICAL REACTIVITY AND VIRAL HEPATITIS. *(E.)* Sherlock, S. (R. Free Hosp., London, England). *Bull. NY Acad. Med.* 51(4):528-532, 1975.

3480 EPIDEMIOLOGY OF VIRAL HEPATITIS B IN THE TROPICS. *(E.)* Francis, T. I. (Univ. Coll. Hosp., Ibadan, Nigeria). *Bull NY Acad. Med.* 51(4): 501-507, 1975.

3481 HEPATITIS A AND B. *(E.)* Carver, D. H.; Seto, D. S. Y. (Johns Hopkins Univ. Sch. Med., Baltimore, Md.). *Pediatr. Clin. North Am.* 21(3):669-681, 1974.

3482 TOWARD HEPATITIS B VACCINES. *(E.)* Zuckerman, A. J.; Howard, C. R. (London Sch. Hyg. Trop. Med., England). *Bull. NY Acad. Med.* 51(4):491-500, 1975.

3483 ENDOGENOUS AND POSTHEPARIN MONOGLYCERIDE HYDROLASE IN PLASMA OF PATIENTS WITH ACUTE VIRUS HEPATITIS. *(E.)* Hansen, W. (Med. Clin. II, Tech. Univ. Munich, Germany). *Klin. Wochenschr.* 53 (3):135-137, 1975.

3484 SPORADIC ENDEMIC OUTBREAKS OF VIRAL HEPATITIS IN ITALY AND IN MARCHE PROVINCE OVER A TWENTY-YEAR PERIOD. FINDINGS AND CRITICAL ANALYSIS OF 8954 CASES REPORTED IN MARCHE FROM 1960 TO 1969 AND OF 949 CASES REPORTED IN ANCONA FROM 1957 TO 1969. *(It.)* Russi, F.; Svegliati Baroni, A. (Munic. Hosp., Ancona, Italy). *Minerva Med.* 65(90):4779-4795, 1974.

See also, 2875, 3348, 3354, 3361, 3521, 3537, 3549.

LIVER AND BILIARY TRACT

Chronic Hepatitis

3485 IMMUNOGLOBULINS, GLYCOPROTEIDS [SIC!] AND AUSTRALIA ANTIGEN IN CHRONIC LIVER DISEASE. *(E.)* Feher, J.; Jakab, L.; Szilvasi, I. (Semmelweis Univ. Med. Sch., Budapest, Hungary). *Acta Med. Acad. Sci. Hung.* 30(3):197-203, 1973.

The sera of 91 patients with chronic liver disease (16 chronic persistent hepatitis, 25 chronic aggressive hepatitis, 30 cirrhosis of the liver, and 20 fatty infiltration) were studied by radial diffusion to estimate the amount of IgG, IgA, and IgM immunoglobulins, and ceruloplasmin, α_2-macroglobulin, β_1-C-globulin and transferrin. Microcomplement fixation was used to demonstrate the presence of Australia antigen (HB_SAg) and antibody. The titers of humoral antibodies against allogenic hepatocellular nuclei, mitochondria, and soluble protein were estimated by passive hemagglutination. Pooled serum from 100 blood donors served as the control. IgA and IgM levels showed a significant increase in chronic persistent hepatitis compared to the controls as did the levels of all 3 immunoglobulins in chronic aggressive hepatitis and in cirrhosis of the liver. The increase in IgG was particularly marked in chronic aggressive hepatitis. The serum ceruloplasmin and α_2-macroglobulin levels were increased in relation to the extent of the inflammatory process involving the hepatic stroma. In contrast, β_1-C-globulin and transferrin were not significantly affected. HB_SAg and humoral antibodies were seen most frequently in chronic aggressive hepatitis. These results suggest the existence of a definite relationship between the persistence of HB_SAg and the production of chronic parenchymal injury in the liver. They also support the claim that the immune system is affected by chronic hepatitis.

3486 REMISSION OF ACTIVE CHRONIC HEPATITIS AFTER TREATMENT WITH CYCLOPHOSPHAMIDE AND PREDNISOLONE. REPORT OF FOUR CASES. *(E.)* Pengelly, C. D. R.; Jennings, R. C. (Gen. Hosp., Altrincham, Cheshire, England). *Practitioner* 214(1280):233-242, 1975.

Four case reports are presented in which four patients with chronic active hepatitis experienced remission following therapy with prednisolone and cyclophosphamide. The patients, aged 42-74 yr, presented with malaise, dyspepsia, abdominal tenderness and jaundice. All had elevated serum globulins and raised serum aminotransferase levels, and some evidence of disturbed autoimmune mechanisms. Liver biopsy revealed focal necrosis, fibrous bands and plasma cell infiltration. Treatment with cyclophosphamide (25-100 mg/day) and prednisolone (10-20 mg/day) resulted in total remission of disease in three patients with normalization of liver function tests and histology which has persisted for 20-58 months. The fourth patient has progressively improved over a 5 month period. Except for a transcient mild thrombocytopenia in two patients, there were no significant side effects of therapy. It is concluded that combined cyclophosphamide-prednisolone therapy is satisfactory for the treatment of chronic active hepatitis and is probably superior to other modes of therapy because of its ability to suppress autoimmune mechanisms.

3487 INFLUENCE OF AZATHIOPRINE ON HEPATIC RESERVE IN CHRONIC ACTIVE LIVER DISEASE. *(E.)* Rikkers, L.; Sherlock, S. (R. Free Hosp., London, England). *Gut* 16(3):214-219, 1975.

An investigation was conducted to determine if hepatic indocyanine green (ICG) excretion in patients with chronic active liver disease follows saturation kinetics, allowing calculation of the maximal rate of ICG removal (R_{max}), and to assess the role of azathioprine in the management of patients by evaluating the influence of this drug on R_{max}. Following the initial ICG analysis, azathioprine (75 mg/day) was administered to 14 patients (eight men and six women, aged 13-69 yr) with chronic active liver disease. Prednisolone therapy was continued in five patients (10 mg/day). Two weeks later a second ICG study was performed in 11 patients. The hepatic removal in individual ICG doses was exponential in most cases, with the correlation coefficient of

the plasma disappearance rate plot exceeding 0.995 in 66 of 82 dose studies (81%). The general conformity of the data to Michaelis-Menten kinetics was confirmed. Initial values for R_{max} and K_m for all patients were 0.47 mg/kg/min and 6.54 mg/kg resp. R_{max} was significantly higher in untreated patients than for those on maintenance corticosteroids. Following 2 weeks of treatment with azathioprine, no improvement was detected in R_{max} in previously untreated patients, those on maintenance prednisolone, or both groups combined. Thus it appears that at least over the short term, azathioprine has no beneficial influence on the liver's reserve for ICG removal in these patients; in fact, in isolated cases this drug may be detrimental. The results of the study indicate that hepatic removal of incremental doses of ICG is consistent with Michaelis-Menten kinetics in most patients with chronic active liver disease, thus providing a means of estimating a maximal removal fate for this dye.

3488 STUDY OF ANTIBODIES FOR ANTILYMPHOCYTE, Au/SH, AND LIVER TISSUE ANTIGENS IN CHRONIC LIVER DISEASE. *(Hun.)* **Dobias, G.**; Szecsey, G.; Hollos, I.; Barnabas, L.; Kendrey, G. (Dep. Exp. Lab. Anal., Inst Postgrad. Phys., Budapest, Hungary). *Orv. Hetil.* 115(19):1093-1097, 1974.

Lymphocyte cytotoxins, as well as Au/SH and liver tissue antigen antibodies were studied in patients with chronic aggressive hepatitis, chronic persistent hepatitis, and cirrhotic hepatitis. Lymphocyte cytotoxins reacting with allogenic lymphocytes at 15 C were found in serum samples from 30 out of 50 patients. Antibodies reacting with autologous lymphocytes at 15 C were found in 6 out of 50 patients, including two each with chronic aggressive hepatitis, chronic persistent hepatitis, and cirrhotic hepatitis. Lymphocyte cytotoxins reacting with autologous lymphocytes at 37 C were detected in four patients (one case of chronic aggressive hepatitis, two cases of chronic persistent hepatitis, and one case of cirrhotic hepatitis) with below-normal lymphocyte counts, including three cases of leukopenia. Antibodies reacting with untreated Au/SH antigen were found in 14 out of 132 cases, while antibodies reacting with Tween-80-treated Au/SH antigen were found in 38 cases. The incidence of antibodies reacting with liver tissue antigens (MF, SF) was highest in sera from patients with chronic aggressive hepatitis. A significant relationship was established between the presence of Au/SH antigen and liver tissue antigen antibodies in all types of liver diseases studied. Antigen-antibody complexes and several antibodies with different degrees of specificity were found simultaneously in chronic aggressive hepatitis.

3489 CHRONIC HEPATITIS AND AUTOANTIBODIES IN OXYPHENISATIN USE. *(Dut.)* Niermeyer, P.; Gips, C. H.; Trommel, J. (Acad. Hosp., Groningen, Netherlands). *Tidjschr. Gastroenterol.* 17(2): 119-120, 1974.

3490 THE HISTOCHEMISTRY OF ARYLSULFATASE IN CHRONIC LIVER DISEASE. *(Fr.)* Bordeianu, A.; Nicolaescu, T.; Stoiculescu, P.; Bittman, E. (D. Danielopolu Inst. Norm. Pathol. Physiol., Bucharest, Rumania). *Rev. Roum. Physiol.* 11(1): 35-40, 1974.

3491 SOME SERUM PROTEINS IN POSTHEPATITIC SYNDROMES: EVALUATION OF THE POSSIBLE BIOLOGICAL AND DIAGNOSTIC SIGNIFICANCE OF CHANGES IN THEM. *(It.)* Marasini, B.; Stabilini, R.; Del Ninno, E.; Pontello, M.; Agostoni, A. (Inst. Spec. Med. Pathol., Univ. Milan, Italy). *Fegato* 19(3): 571-584, 1973.

3492 CLINICAL AND BIOPSY FINDINGS IN AUSTRALIA ANTIGEN-POSITIVE BLOOD DONORS. *(Ger.)* Schlicht, I.; Hasse, W.; Alexander, M.; Weisse, W.; Sucker, U. (Med. Clin. Polyclin., Free Univ. Berlin, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:974-977, 1973.

3493 THE PATHOGENESIS AND CORRECTION OF HEPATIC BLOOD FLOW IN CHRONIC HEPATITIS AND CIRRHOSIS. *(Rus.)* Khanin, M. N.; Mankus, T. G. (Tashkent Med. Inst., USSR). *Patol. Fiziol. Eksp. Ter.* (6): 6-11, 1973.

3494 CRITICAL LONG-TERM STUDY OF THE ADMINISTRATION OF ESSENTIAL PHOSPHOLIPIDS TO PATIENTS WITH CHRONIC LIVER DISEASE. *(Ger.)* Hirsch, W.; Freude, J. (Schwerpunkt Hosp., Traunstein/Upper Bavaria, Germany). *Therapiewoche* 24(38):4176,4179-4180, 1974.

3495 IMMUNOSUPPRESSIVE THERAPY IN PROGRESSIVE HEPATITIS. *(It.)* Fiaccadori, F.; Camilloni, R.; Canaletti, R. (Reg. Hosp., Parma, Italy). *Fegato* 19(3):585-595, 1973.

3496 MARGINAL LIVER RESECTION IN CHRONIC HEPATITIS AND CIRRHOSIS. *(Por.)* Ardamatskaya, A. N. (Sao Lucas Sanit., Sao Paulo, Brazil). *Bol. Sanatorio Sao Lucas* 35(6):121-124, 1974.

3497 ACTIVE CHRONIC HEPATITIS IN SRI LANKA PATIENTS. *(E.)* Nagaratnam, N.; DeSilva, D. P. K. M.; DeSilva, S. P. (Gov. Hosp., Colombo, Sri Lanka). *Digestion* 11(3/4):249-256, 1974.

3498 Q FEVER ENDOCARDITIS AND CHRONIC LIVER INVOLVEMENT. Delaney, J. C.; Roberts, H. L. (David Lewis North. Hosp., Liverpool, England). *Practitioner* 214(1280):243-245, 1975.

3499 THE ENZYMATIC DIFFERENTIATION OF VARIOUS CLINICAL FORMS OF CHRONIC HEPATITIS. *(Ger.)* Maier, K. P.; Volk, B.; Talke, H.; Gerok, W. (Med. Clin., Univ. Freiburg/Breisgau, Germany). *Therapiewoche* 24(50):5986, 1974.

3500 COEXISTENCE OF RAYNAUD'S PHENOMENON AND CHRONIC ACTIVE HEPATITIS WITH HEPATITIS B ANTIGEN. *(E.)* Kim, W. K.; Koff, R. S. (Boston VA Hosp., Mass.). *Digestion* 11(1/2):152-156, 1974.

See also, 2664, 2875, 2923, 2930, 2960, 3441, 3445, 3454, 3528, 3536, 3549.

LIVER AND BILIARY TRACT

Alcoholic Liver Disease

3501 LIVER BLOOD FLOW IN ALCOHOLIC CIRRHOSIS. *(Fr.)* Huet, P. M.; Marleau, D.; Lavoie, P.; Viallet, A. (St. Luc Hosp., Montreal, Canada). *Union Med. Can.* 103(12):2069-2077, 1974.

The severity of portal hypertension in cirrhosis is best evaluated by measuring the portal-hepatic gradient. This gradient ranged from 7 to 26 mm Hg in 54 patients with alcoholic cirrhosis. The portal-hepatic gradient was greater than 12 mm Hg in all patients who had bleeding esophageal varices diagnosed at emergency endoscopy. The varices were 3-4 mm in diameter or larger in all patients with bleeding varices. These results suggest that cirrhotics with portal-hepatic gradients greater than 12 mm Hg are potential bleeders. A portal-hepatic gradient less than 12 mm Hg and small varices suggest that varices are not the cause of upper gastrointestinal bleeding in patients with alcoholic cirrhosis. After combined catheterization of subhepatic umbilical and portal veins and the upper mesenteric artery, ^{51}Cr-labeled RBC were injected into the upper mesenteric artery and dilution curves were obtained for 18 cirrhotics with severe portal hypertension. The portal fraction of total liver blood flow ranged from 30 to 100% (mean 67.3%). There was no correlation between the portal fraction of total liver blood flow and indocyanine green (ICG) clearance, the portal-hepatic gradient, or total liver blood flow. These results suggest that this technique could be used to select candidates for shunt surgery after a critical value for portal blood flow has been established. By using the same catheterization technique, it was demonstrated that ^{125}I-labeled albumin microaggregate uptake ranged from 5.2 to 100% (mean 48.8%) and ICG uptake from 3.9 to 54.0% (mean 22.4%) in 10 patients with cirrhosis. In contrast, normal values were measured in 4 patients with idiopathic portal hypertension. A highly significant correlation between ^{125}I-labeled albumin microaggregate and ICG uptake was found in these 14 patients, as was a highly significant correlation between ^{125}I-labeled albumin aggregate uptake and relative ICG clearance. This suggests that the decrease in these substances is secondary to changes in hepatic microcirculation. The decrease in ^{125}I-labeled albumin uptake which occurs during cirrhosis might result from the fact that some portal blood does not perfuse Kupffer cells because of portohepatic shunts. Thus, ^{125}I-labeled albumin microaggregate uptake might also be used to estimate functional portal flow in cirrhotics.

3502 IDENTIFICATION OF ACTIN-LIKE PROTEINS IN ALCOHOLIC HYALINE BY IMMUNOFLUORESCENCE. *(E.)* Nenci, I. (Inst. Pathol. Anat, Univ. Ferrara, Italy). *Lab. Invest.* 32(2):257-260, 1975.

Alcoholic liver disease Mallory bodies were tested for the presence of actin by means of antiactin antibodies. Liver biopsies were taken from 5 chronic alcoholic liver disease patients and 3 control non-alcoholic patients. Sera of patients with chronic aggressive hepatitis were tested for antiactin antibodies by indirect immunofluorescence. None of the sera contained antimitochondrial, antinuclear, or antireticulin autoantibodies. Cryostat sections of the liver specimens were treated with a 1:50 dilution of the antiactin antibody serum and reacted with fluorescein isothiocyanate conjugated goat anti-human immunoglobulin antiserum. Readings were made by immunofluorescence microscope. Control specimens were treated either with antiactin antibody serum as above, innoculated with normal human sera lacking smooth muscle autoantibodies, or incubated with goat anti-human immunoglobulin antiserum after application of the antiactin antibody sera. All of the antiactin antibody-containing sera stained the Mallory bodies by indirect immunofluorescence. The fluorescent appearance was consistent with the light microscope appearance. Strongest staining was seen in the hepatocytes. In addition to the Mallory bodies, stain was picked up in a polygonal pattern near the cell membrane in some cells. Normal sera did not show any staining effect on either alcoholic or control specimens. The control specimens occasionally showed a weak polygonal staining of the cell membrane with the antiactin antibody sera. No fluorescence was observed when unlabeled antiserum was used before fluorescein-conjugated antiserum. It is concluded that Mallory bodies in the liver cells of alcoholic patients contain actin-like immunoreactive proteins, and may represent a quantitative alteration of contractile proteins resulting from the disease process.

3503 HYPOGONADISM IN ALCOHOLIC LIVER DISEASE: EVIDENCE FOR A DOUBLE DEFECT. *(E.)* Van Thiel, D. H.; Lester, R.; Sherins, R. J. (Dep. Med., Univ. Pittsburgh, Pa.). *Gastroenterology* 67(6):1188-1199, 1974.

Hypothalamic-pituitary-gonadal function was evaluated in 40 men with a wide spectrum of alcoholic liver disease to identify an anatomic location and biochemical mechanism responsible for observed hypogonadism and feminization. Basal plasma concentrations of follicle-stimulating hormones, luteinizing hormone, estradiol, and testosterone were determined. Hormonal responses to provocative clomiphene and chorionic gonadotropin stimulation were evaluated. Sex steroid-binding globulin capacity was determined to evaluate plasma concentrations of free sex steroid. No correlation between any specific biochemical assessment of the severity of liver disease and the degree of hormonal derangement was noted. However, mean plasma testosterone levels were lower in association with more severe derangements of hepatic histology. Both follicle-stimulating hormone and luteinizing hormone concentrations ranged from normal to moderately elevated with means values (19.8 and 17.2, resp.) statistically elevated when compared to normal means (follicle-stimulating hormone, 11.6 and luteinizing hormone, 8.8). Total plasma estradiol levels were normal or reduced, but the mean (35.6) did not differ from normal. In contrast, plasma testosterone was reduced in half of the men to a mean of 313, which differed significantly from the normal mean of 519. Further magnifying the reduction in testosterone, there was an 8-fold elevation of sex steroid-binding globulin (4.325 compared to normal values of 0.521). Clomiphene response was markedly diminished in the majority with 2/3 failing to produce a 50% increase of either gonadotropin. Similarly, more than 1/3 failed to show a 50% increase in plasma testosterone after exogenous chorionic gonadotropin. Thus, both primary gonadal failure and hypothalmic-pituatary suppression are demonstrable in men with alchoholic liver disease. These abnormalities may result from the ingestion of alchohol. However, function rather than from alcohol ingestion *per se* must not be overlooked. Gonadal atrophy and hypothalmic-pituitary suppression in alcoholic liver disease may result from defective hepatic regulation of estrogenicity. In the face of hepatic damage, nonsteroidal estrogens may be insufficiently metabolized or excreted by the liver, excessive concentrations may accumulate in plasma, and this accumulation may result in target organ stimulation. The possibility that feminization of patients with liver disease results from the accumulation of exogenous rather than endogenous estrogen should be examined. Similarly, the finding of the lowest plasma gonadotropin values and the most severe gonadal failure in those men with the most advanced liver disease may result from increased retention of nonsteroidal estrogen.

3504 THE EFFECT OF CIRRHOSIS ON THE DISPOSITION AND ELIMINATION OF CLINDAMYCIN. *(E.)*

Avant, G. R.; Schenker, S.; Alford, R. H. (Vanderbilt Med. Sch., Nashville, Tenn.). *Am. J. Dig. Dis.* 20(3):223-230, 1975.

The effect of liver disease in patients and of experimental hepatic damage in rats on the disposition and elimination of clindamycin was investigated. Seven patients, average age 41.57 yr, were studied, of whom four had ascites, five had esophageal varices and three had signs of hepatic encephalopthy on earlier occasions. One patient had received 6 capsules of Dyazide (50 mg triamterene and 25 mg hydrochlorothiazide each) during the 3 days prior to the study. The results showed significant impairment of clindamycin elimination in the patients. However, the prolongation of the drug half-life was only modest about 1 hr, 31% over the normal value of 3.42 hr. The half-life in the cirrhotics correlated positively with total serum bilirubin and with SGOT, but not with other liver function tests. It is suggested, assuming higher values for these two tests imply increasing severity of liver disease, that in patients with more extensive hepatic dysfunction greater impairment of clindamycin elimination would be found. Pharmacokinetic analysis of these data suggest that the prolongation of clindamyacin half-life in cirrhosis resulted from decreased drug clearance, not from increases in the volume of distribution. The altered drug clearance in cirrhosis may represent impaired hepatic elimination. Clindamycin serum protein binding in both control and cirrhotic patients was of the order of 79%. The lack of significant decrease of serum binding of clindamycin in cirrhosis is consistent with the absence of a significant increase in the volume of distribution of the drug in this group. Studies were also carried out in Sprague-Dawley rats with hepatic dysfunction caused by CCl_4 pretreatment (0.6 ml/kg) or bile duct ligation. The prolongation of clindamycin half-life obtained with acute hepatic injury of 24 hr duration was highly significant. The data suggest that acute hepatic injury may cause major changes in clindamycin elimination. In conclusion, there was a statistically significant but only modest impairment of clindamycin elimination in this group of alcoholic cirrhosis patients. Animal data suggested that significant changes also could occur with acute hepatic dysfunction and cholestasis.

3505 INCREASED RATE OF ALCOHOL REMOVAL FROM BLOOD WITH ORAL FRUCTOSE AND SUCROSE. *(E.)*

Soterakis, J.; Iber, F. L. (Tufts Univ. Sch. Med., Boston, Mass.). *Am. J. Clin. Nutr.* 28(3):254-257, 1975.

The effect of oral glucose, fructose, and sucrose on the disappearance rate for i.v. administered alcohol was studied in 8 abstinent alcoholic subjects (all males, aged 25-53 yr). The 3 sugars were ingested on separate days in random sequence. After an overnight fast, subjects drank a lemon-flavored solution of glucose (2 g/kg), fructose (2 g/kg), or sucrose (4 g/kg). Alcohol levels were determined at hourly intervals. During ingestion of the sugars, the mean rates of alcohol disappearance were: 19 mg/100ml/hr for glucose; 23.9 mg/100 ml/hr for sucrose, and 25.4 mg/100 ml/hr for fructose. Compared with glucose, both fructose and sucrose increased the rate of removal of alcohol from the blood. Blood fructose levels were similar after the oral dose of fructose or sucrose. Sucrose is more readily available and cheaper to use than fructose and can be used instead of fructose to ac-

celerate alcohol metabolism. Minimal complications were experienced from ingestion of fructose and sucrose. The time necessary to lower blood alcohol levels from 250 mg/100 ml to 40 mg/100 ml should be 3-4 hr shorter with p.o. fructose or sucrose than with glucose. It is noted that blood disappearance of alcohol is not synonymous with sobering or becoming mentally clear.

3506 THE IMPORTANCE OF LIVER BIOPSIES IN THE DIAGNOSIS OF CLINICALLY MANIFEST ALCOHOLIC LIVER DISEASE. *(Ger.)* Stotzner, H. (Carl Gustav Carus Med. Acad., Dresden, Germany). *Zentralbl. Alg. Pathol.* 118(4):367-374, 1974.

To determine whether alcoholic liver damage can be diagnosed by histological changes alone, 29 histological features were studied in liver biopsies from 43 patients (34 men and nine women, aged 31-69 yr, mean age 45.9 yr). Of these patients, 33 had consumed between 15 and 450 g/day of alcohol for 4-22 yr (mean 10.2 yr); no accurate information was available on the drinking habits of the remaining 10 patients. Before the biopsies were taken, none of the patients had been given any drugs known to cause liver damage. None of these patients had any clinical evidence of viral hepatitis or hepatobiliary disease. Except for alcoholic hyaline and alcoholic hepatitis, no significant correlations were found between any of the parameters studied. However, five to eight of the following parameters were present in 40 of the 43 patients (93%): cholestasis, giant mitochondria, alcoholic hyaline, focally increased basophilia in the cytoplasm of liver cells, cytoplasmic lakes in the hepatic epithelium, steatosis, siderosis, and fibrosis. In liver biopsies from unselected patients, five or more of the above criteria were found in only two patients who had no history of alcohol consumption. However, both of these patients had been given drugs known to cause liver damage before the biopsies were taken. In the 43 patients whose biopsies were studied in detail, 42 had inflammatory changes in the liver. However, this inflammation fulfilled the criteria for alcoholic hepatitis in only 17 cases. Only 10 of these patients (26%) had evidence of portal hypertension, so that a diagnosis was established in most cases before irreparable liver damage had occurred.

3507 INDUCTION OF DRUG-METABOLIZING ENZYMES IN CHRONIC ALCOHOLICS. *(Ger.)* Gundert-Remy, U.; Marquardt, R.; Andritsch, F.; Weber, E. (Med. Clin., Heidelberg, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:907-908, 1973.

To determine whether alcohol induces microsomal, drug-metabolizing enzymes in the livers of chronic alcoholics, the half-lives of antipyrine and tolbutamide were measured in plasma from patients hospitalized for chronic alcoholism before and 4 weeks after abstention from alcohol and from nonalcoholic controls. Antipyrine (15 mg/kg) was administered to five alcoholics and five controls, and tolbutamide, to two alcoholics and six controls. None of the alcoholics were given any drugs for at least 3 weeks before the second test. The mean half-lives of antipyrine were lower in alcoholics than in nonalcoholic controls, suggesting that alcohol does induce drug-metabolizing enzymes in the livers of these patients. However, when the two tests were compared for individual alcoholics, half-lives increased in only two of five patients. Changes in the half-lives of antipyrine were of the same order of magnitude in alcoholics (-0.6 hr) and controls (-0.4 hr). Similar results were obtained with tolbutamide. It is concluded that alcohol does not induce drug-metabolizing enzymes in the livers of chronic alcoholics.

3508 GLYCOGENOLYSIS AND GLUCONEOGENESIS IN HUMAN LIVER AS INFLUENCED BY ETHANOL. *(Ger.)* Dietze, G.; Wicklmayr, M.; Grunst, J.; Hepp, K. D.; Braun, S.; Mehnert, H. (Schwabing Hosp., Munich, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:911-914, 1973.

Catheters were inserted into the hepatic veins and needles into the femoral arteries of 14 normal subjects who had fasted for 14 hr. After a 30 min basal period, alcohol was infused into the cubital vein at a rate of 15 g/5 min which was later decreased to 0.2 g/min. Blood samples were taken before alcohol infusion and at 10 min intervals for 1 hr thereafter to determine insulin, glucose, lactate, pyruvate, β-hydroxybutyrate, acetoacetic acid, glycerol, and amino acids. Similar determinations were performed on six controls who received i.v. infusions of physiological saline. Liver blood flow was measured throughout with an ^{133}Xe inhalation technique. Within 10 min after alcohol infusions were begun, ethanol concentrations in the femoral artery and hepatic vein reached a steady state at a concentration of 9 mM, and glucose production increased by 60%. After 50 min, glucose production decreased to values which were lower than those in the controls. Glycerol utilization increased significantly after 30 min and reached initial values after 50 min, while alanine utilization increased immediately after alcohol infusions were begun and remained elevated for about 30 min; a significant decrease occurred 20 min later. The uptake of lactate ceased entirely during administration of alcohol, and lactate production began shortly after alcohol infusions began. By assuming that lactate, alanine, and glycerol are used only to produce glucose and are converted into glucose in stochiometric proportions, 40% of the glucose produced in the liver under basal conditions results from gluconeogenesis and 60% from glycogenolysis. When alcohol is infused, gluconeogenesis decreases by 75% and remains essentially unchanged throughout the observation period. Thus, the increase in glucose production induced by ethanol can be attributed to a large increase in the rate of glycogenolysis.

3509 ACQUIRED DYSERYTHROPOIETIC ANEMIA IN CHRONIC LIVER DISEASE (ALCOHOLIC CIRRHOSIS). *(Ger.)* Riedler, G. F.; Schmid, M. (Waid Munic. Hosp., Zurich, Switzerland). *Schweiz. Med. Wschr.* 104(39):1393, 1974.

Hematological test findings in three patients with serious alcoholic liver cirrhosis are presented with respect to the pathogenesis of acquired dyserythropoietic anemia. Typical macrocytic anemia with target cells and stomatocytes, and increased rate of erythropoiesis with normal sideroblasts were detected in all three patients. The first patient (aged 44 yr, male) additionally showed acquired, refractory anemia, bizarre karyoclasis, polynuclear erythroblasts with filamentous interchromatin bridges, and reduced reticulocyte count in the bone marrow. ^{59}Fe Incorporation was 18%, and the calculated ineffective erythropoiesis was 63.37 mg/day against a normal range of 6-26 mg/day. The second patient (aged 61 yr, male) showed a reduced variety of karyoclases, and few polynuclear erythroblasts. The iron incorporation amounted to 51%. Increased erythropoiesis and normal iron incorporation were found in a third, 59-yr-old female patient. The PAS, ham and sucrose tests were negative in all patients. The findings indicate acquired dyserythropoietic anemia in the first patient, and the comparison with the other patients suggests a smooth transition from pure ineffective erythropoiesis to dyserythropoietic anemia in patients with serious chronic liver disease.

3510 PRELIMINARY OBSERVATION OF d-PENICILLAMINE THERAPY IN ACUTE ALCOHOLIC LIVER DISEASE. *(E.)* Resnick, R. H.; Biotnott, J.; Iber, F. L.; Makopour, H.; Cerda, J. J. (Lemuel Shattuck Hosp., Boston, Mass.). *Digestion* 11(3/4):257-265, 1974.

The effect of penicillamine on the mortality rate, hepatic dysfunction, and histopathology of acute alcoholic liver disease was studied in a prospective controlled trial. Hospitalized patients with this condition (19) were given penicillamine (250 mg 4 times a day) p.o. for 8 weeks, and 21 similar patients were given a placebo for the same period of time. The penicillamine and placebo groups did not differ significantly in terms of mortality rate or longevity; in each group, the deaths were due to hepatic failure characterized by increasing jaundice and ascites. Although total bilirubin and SGOT values improved significantly within each group during the study, the two groups did not differ significantly from each other in terms of hepatic function. However, compared with the placebo group, the penicillamine group showed a greater reduction in total and active fibrosis and cellular injury during the 8-week treatment program. Determinations of histologic diagnosis also suggested improvement consequent to penicillamine treatment, although the differences between the penicillamine and placebo groups in this respect were not significant. Since penicillamine failed to improve survival rates or liver function parameters in these patient, the routine use of this drug in the management of alcoholic hepatitis cannot be justified. However, this agent may find ultimate use in the treatment of chronic hepatic disorders associated with fibrogenesis.

3511 EARLY DIAGNOSIS OF FIBROUS LESIONS OF THE LIVER IN CHRONIC ALCOHOLICS. *(Fr.)* Berthet, P.; Bel, A.; Girard, M. (no affil.). *J. Med. Lyon* 55(1271):821-836, 1974.

3512 INFLAMMATORY STEATONECROSIS OF THE ALCOHOLIC LIVER (ACUTE ALCOHOLIC HEPATITIS: FOUR CASES). *(Fr.)* Tolot, F.; Girard, D.; Pelletier, M.; Bernier, E. (Jules Courmont Hosp., Lyon, France). *J. Med. Lyon* 55(1266):421-431, 1974.

3513 THROMBOPENIA IN THE ALCOHOLIC. *(Fr.)* Terrasse, J.; Moinade, S.; Decombas, J. P. Y. (Med. Clin. B., Clermont-Ferrand, France). *Rev. Fr. Gastroenterol.* (98):5-11, 14, 17-21, 24, 28, 1974.

3514 ISOLATION OF MALLORY BODIES BY POLYMER TWO-PHASE SYSTEM. *(E.)* Harwood, T. R.; Yokoo, H. (VA Res. Hosp., Chicago, Ill.). *Fed. Proc.* 34(3):843, 1975.

3515 DIFFERENCES IN ADIPOSE TISSUE METABOLIC ACTIVITIES BETWEEN PATIENTS WITH ALCOHOL- AND CARBOHYDRATE- INDUCED HYPERLIPEMIA. *(E.)* Kuo, P. T.; Fan, W. C.; Hayase, K.; Thyrum, E. M.; Kostis, J. B. (Rutgers Med. Sch., Piscataway, N.J.). *Am. J. Clin. Nutr.* 28(4):424, 1975.

3516 PLASMA AMINO ACIDS IN ALCOHOLIC LIVER INJURY: CONTRAST WITH PROTEIN MALNUTRITION. *(E.)* Shaw, S.; Lieber, C. S. (Bronx VA Hosp., N.Y.). *Am. J. Clin. Nutr.* 28(4):423, 1975.

3517 IMPAIRED UTILIZATION BY CHRONIC ALCOHOLICS OF YEAST AS A SOURCE OF FOLIATES. *(E.)* Frank, O.; Zetterman, R.; Rajan, K. S.; Baker, H. (New Jersey Med. Sch., Newark). *Am. J. Clin. Nutr.* 28(4):419, 1975.

3518 ELECTROLYTE IMBALANCE IN ALCOHOLIC LIVER DISEASE. *(E.)* Sturner, W. Q.; Coe, J. I. (Univ. Texas Southwest. Med. Sch., Dallas). *J. Forensic Sci.* 18(4):355-360, 1973.

See also, 2875, 3521.

3519 THE PREDICTION OF THE OUTCOME OF PORTACAVEL [SIC!] SHUNT USING BROMSULPHTHALEIN (BSP): A RETROSPECTIVE ASPECT. *(E.)* Turner, J.; Cuschieri, A.; Shields, R. (Dept. Surg., Univ. Liverpool, England). *Br. J. Surg.* 61(10):828-831, 1974.

The use of compartmental BSP kinetics to predict the outcome of portacaval shunt operations was investigated in 17 patients who underwent elective portacaval shunt. The indication for operation in each case was previous hemorrhage from esophageal varices. In all patients the portal hypertension was the result of hepatic cirrhosis. The survival range after operation was 2 weeks to 14 yr. BSP (3-4 mg/kg) was injected i.v. after an overnight fast. Venous blood was obtained from the other arm through a wide bore cannula, initially at 2-min intervals, later at 5-min intervals, and finally at 10-min intervals over a period of 80 min. In each sample the plasma concentration was determined spectrophotometrically. The equivalent liver volume is given by aV/b, where V is the plasma volume, a is the rate constant for the movement of BSP from plasma to liver, and b, the rate constant for the movement of BSP from liver to plasma (a and b are derived from the plasma disappearance curve of BSP when plotted on semilogarithmic paper). The equivalent liver volume is an expression of the storage capacity of the liver for BSP and is the volume of plasma which would contain the same amount of BSP as the liver. The mean value for equivalent liver volume in the 17 patients studied was 0.59 liter/kg. In those in whom the clinical outcome of portacaval shunt was regarded as good (six patients) the preoperative equivalent liver volume in every case but one was more than 0.75 liter/kg, whereas among those in whom the results were poor, the equivalent liver volume was less than 0.75 liter/kg. It appears that a patient with an equivalent liver volume of less than 0.5 liter/kg before operation had a high risk of dying or developing chronic hepatic failure if he survived the operation. Although these results are from a retrospective study of a small number of patients, they suggest that the equivalent liver volume may be of considerable predictive value for shunt operation.

3520 INTRACISTERNAL HYALINE IN HUMAN BIOPSIES. *(Ger.)* Pfeifer, U.; Klinge, O. (Pathol. Inst., Univ. Wurzburg, Germany). *Verh. Dtsch. Ges. Pathol.* 57:438, 1973.

Unusual cytoplasmic hyaline inclusions were found in the livers of two patients with cirrhosis and in one with an unclassifiable form of chronic progressive parenchymal damage. In one cirrhotic they consisted of many spheres, up to 15 μ in diameter, which stained positively with PAS reagent and were resistant to diastase. In the second cirrhotic, the inclusions were irregular in form and PAS-negative. PAS-negative hyaline inclusions occurred primarily at the periphery of the lobules and measured about 7 μ in diameter in the third case. In all three cases, Laqueur's acid fuchsin stain was negative. Electron microscopy showed that some of the inclusions were surrounded by a membrane, studded in places with ribosomes and bound directly to cisternae in the rough endoplasmic reticulum. Lipid droplets were present in the inclusions in the first two cases. These findings suggest that there is a disorder in the transport of protein in these hyaline inclusions.

3521 THE ASSOCIATION OF SYPHILIS WITH CIRRHOSIS: THE ROLE OF ALCOHOL AND SERUM HEPATITIS. *(E.)* Sadikali, F. (Makerere Univ. Med. Sch., Kampala, Uganda). *Postgrad. Med. J.* 51(592):69-73, 1975.

The role of syphilis and alcohol was investigated in a prospective study of 80 patients with cirrhosis of the liver in Uganda. Results were correlated with the histological type of cirrhosis, and serological tests for hepatitis B antigen (HB Ag). Eighteen (22.5%) patients with histologically-proven cirrhosis had positive seriology for syphilis (VDRL and TPI). A high incidence of alcoholism (80%) and syphilis (60%) was found in patients with micronodular cirrhosis who were all negative for HB Ag. By contrast, HB Ag was detected in 37% of patients with macronodular cirrhosis who had a much smaller incidence of syphilis and alcoholism. Although chronic infection with hepatitis B virus related to HB Ag appears to be an important factor in the pathogenesis of cirrhosis in at least 30% of cases, infection acquired during past treatment for syphilis is not an important cause of the association of syphilis with cirrhosis in this population. Subdivision of patients with cirrhosis into those with and those without a history of severe alcohol abuse showed that the difference between the incidence of syphilis in the two groups is statistically significant. However, evidence of syphilis in association with non-alcoholic as well as alcoholic cirrhosis in this and other previously reported series suggests that the association between the two diseases cannot be entirely explained through the common factor of alcoholism, and other factors may also be responsible.

3522 PRIMARY BILIARY CIRRHOSIS IN BROTHERS. *(E.)* Bown, R.; Clark, M. L.; Doniach, D. (St. Bartholomew's Hosp., London, England). *Postgrad. Med. J.* 51(592):110-115, 1975.

Case histories of two brothers with classical primary biliary cirrhosis are presented. Both patients, who presented at age 58, developed abnormal liver function tests, jaundice, hepatomegaly and portal hypertension which progressed eventually to coma and death. Both had antimitochondrial antibodies while one also exhibited smooth muscle antibodies. One became Australia antigen-positive terminally. Liver biopsies revealed advanced primary biliary cirrhosis. Both patients also developed an associated keratoconjunctivitis sicca. In one, renal tubular acidosis

and ruptured esophageal varices occurred following lactulose therapy. Screening of the family revealed three relatives with overt thyroid disease, one sister with a high anti-thyroid antibody titer, and several other members with autoimmune diseases or auto-antibodies. This representes the first known report of primary biliary cirrhosis in brothers.

3523 PHENOBARBITAL EFFECTS IN CHOLESTATIC LIVER DISEASE. *(E.)* Bloomer, J. R.; Boyer, J. L. (Yale Univ. Sch. Med., New Haven, Conn.). *Ann. Intern. Med.* 82(3):1-5, 1975.

The effects of short-term phenobarbital administration on liver function and disease progression were studied in seven patients with primary biliary cirrhosis, two with sclerosing cholangitis, three with intrahepatic biliary hypoplasia and three with cholestatic hepatitis. Phenobarbital was given p.o. 120-250 mg/day for 1-5 months. Except for those patients with cholestatic hepatitis, total serum bilirubin declined during therapy from a mean of 7.0 mg% to 3.6 mg% with concomitant relief of pruritus. Some patients also showed reduced serum bile acid concentrations which, however, did not correlate with the extent of decrease in bilirubin. The mean serum cholate:chenodeoxycholate ratio decreased from 2.1 to 1.7, both substances declining during therapy. Although some patients showed slight improvement in BSP excretion and hepatic uptake of ^{131}I-rose benegal, the changes were not significant ($P > 0.10$). Serum cholesterol concentrations and other hepatic function tests also were not significantly changed except for alkaline phosphatase which rose in 12 of 15 patients. It is concluded that short-term phenobarbital administration is helpful in selected patients with intrahepatic cholestasis.

3524 RELATION BETWEEN MORPHOLOGY AND FUNCTION IN PRETERMINAL DIGITAL CIRCULATION IN CIRRHOSIS. II. *(It.)* Andreuzzi, P.; Curri, S. B.; Redaelli, T.; Cantoni, L. (Maggiore Ca' Granda Hosp.; Milan, Italy). *Minerva Med.* 65(40):2287-2295, 1974.

The relation between morphology and function in preterminal digital circulation was studied in 16 patients with cirrhosis of the liver by oscillographic, plethysmographic, and rheographic methods. All patients showed serious, bioptically demonstrated changes in the arteriovenous anastomoses. Abnormal plethysmograms in 10 cases, considerable reduction of the pulse volume with reduced or suppressed dicrotism, and reduced arterial flow rate following the venous congestion test in 5 cases were observed. The marked vasomotor hypertonia was dispelled by indirect heating. The findings indicate the morphological and functional involvement of the digital derivative circulation in liver cirrhosis. While the changes observed are similar to those found in physiological senility and during the initial stages of peripheral vascular diseases, the arteriosclerotic and atheromatous phenomena are less severe in cirrhosis.

3525 HYPERNATREMIA FOLLOWING GASTROINTESTINAL BLEEDING IN CIRRHOSIS WITH ASCITES. *(E.)* Rodes, J.; Arroyo, V.; Bordas, J. M.; Bruguera, M. (Clin. Prov. Hosp., Univ. Barcelona, Spain). *Am. J. Dig. Dis.* 20(2):127-133, 1975.

Plasma hypernatremia and hyperosmolality produced by osmotic diuresis following gastrointestinal bleeding, occurred 6 times in 3 patients. In each case the patient presented with cirrhosis and ascites. The relationship of the diuresis, and increase in blood urea concentration and excretion, and the close temporal relationship between the episodes of diuresis and the gastrointestinal bleeding suggested that the diuresis was due to increase in blood urea from intestinal absorption of blood. Hypernatremia results in cirrhosis and ascites because of low natriuresis due to low distal sodium resorption probably resulting from hyperaldosteronism. It is suggested that osmotic diuresis be suspected whenever there is polyuria and azotemia associated with intestinal bleeding.

3526 REDUCED SERUM SOMATOMEDIN ACTIVITY IN PATIENTS WITH CHRONIC LIVER DISEASE. *(E.)* Wu, A.; Grant, D. B.; Hambley, J.; Levi, A. J. (Northwick Park Hosp. Clin. Res. Cent., Harrow, England). *Clin. Sci. Mol. Med.* 47(4):359-366, 1974.

Serum somatomedin activity in 21 patients with liver disease was studied in relation to fasting serum growth hormone levels and biochemical liver function tests. Ten patients had micronodular cirrhosis, 8 hepatofibrosis, 2 fatty change, and 1 hepatoma. Blood samples were taken by venipuncture after an overnight fast, and somatomedin activity was estimated by chick cartilage assay. Serum growth hormone was estimated by double-antibody radioimmunoassay. The serum somatomedin values were low in 9 patients with cirrhosis (0.042-0.65), 1 with hepatofibrosis (0.27) and the 1 with hepatoma (10.10), relative to values from normal controls. Of these 11, the lowest values were from 5 that had ascites (0.04-0.62). Serum from the patients with low values had no inhibitory effect on control serum activity. Seven of the low value patients had serum growth hormone levels above normal, 6 had low serum albumin (23-33 g/liter), and 8 had high serum total bilirubin (16-117 μM/liter). A significant negative correlation was found between somatomedin activity and alkaline phosphatase. The inverse relationship between somatomedin and growth hormone levels, and the correlation between low somatomedin activity and abnormal liver function tests suggest that the liver is an important site for somatomedin synthesis.

3527 COLLAGEN BIOSYNTHESIS IN LIVER DISEASE OF THE ALCOHOLIC. *(E.)* Chen, T. S. N.; Leevy, C. M. (Coll. Med. Dent. N.J., Newark). *J. Lab. Clin. Med.* 85(1):103-112, 1975.

Patterns of collagen synthesis were investigated in alcoholic patients with fatty liver (6), alcoholic

hepatitis (4), active Laennec's cirrhosis (8), and normal liver (3). Biopsy specimens were taken 72 hr after treatment for possible vitamin or mineral deficiencies. Collagen biosynthesis was measured by *in vitro* incorporation of ^{3}H-proline into the salt soluble and salt insoluble collagen fractions. In one set of experiments, 21.7 μM/ml of ethanol was added to the incubation medium, and incubated 2 hr. Saline was used as a control. Autoradiographic studies of each liver specimen were made, some in which tissues were first digested with collagenase prior to coating with emulsion. It was found that the salt-soluble:salt-insoluble collagen ratio was decreased in both alcoholic hepatitis and cirrhosis, but unchanged in fatty liver. The ^{3}H-proline uptake was significantly increased in fatty liver, hepatitis and cirrhosis in both salt-soluble and insoluble fractions while ^{3}H-hydroxyproline uptake was increased 5-fold in cirrhosis in the salt-soluble collagen and increased in the hepatitis and cirrhosis in the salt-insoluble collagen. The *in vitro* ethanol caused a significant increase in both the ^{3}H-proline and hydroxyproline in the soluble and insoluble fractions in both hepatitis and cirrhosis. In the autoradiographic studies, normal specimens showed sparse labeling of the Kupffer cells, while fatty liver showed a concentration of label in the portal areas and in the hepatocytes. The hepatitis specimens showed labeling of mainly the portal and centrilobular areas, concentrating over many cell types, and the cirrhosis specimens showed labeling in the portal areas, mainly over mesenchymal cells, ductular cells and collagen fibers. It is concluded that salt-insoluble collagen synthesis is increased in alcohol-induced hepatitis and cirrhosis, due to liver cell damage and to the presence of ethanol.

3528 THE FIBRINOLYTIC ENZYME SYSTEM IN ACUTE AND CHRONIC LIVER INJURY. *(E.)* Mowat, N. A. G.; Brunt, P. W.; Ogston, D. (Dep. Med., Univ. Aberdeen, Scotland). *Acta Haematol. (Basel)* 52(5): 289-293, 1974.

The major components of the fibrinolytic enzyme system were compared in 35 patients with hepatic cirrhosis (10), alcoholic liver disease (9), primary biliary cirrhosis (9), and chronic active hepatitis (6). In the hepatic cirrhosis patients, although increased plasma fibrinolytic activity was seen in some, the mean level was not significantly different from control values (373 mg/100 ml). The mean plasminogen level, however, was significantly lower (3.9 *versus* 4.4 casein μ/ml), and both α_1-antitrypsin (379 mg/100 ml) and α_2-macroglobulin (399 mg/100 ml) were increased over control values of 275 and 271, resp. The chronic active hepatitis patients were similar to the previous group in their increased activator (5.8 U) and reduced plasminogen activity (3.4 casein μ/ml). In contrast, those with alcoholic liver disease showed decreased activator (2.6 U) and normal plasminogen activities. The patients with primary biliary cirrhosis had low mean activator levels (2.7 U) while fibrinogen (438 mg/100 ml), α_2-macroglobulin levels (364 mg/100 ml) were all significantly elevated. It is concluded that fatty infiltration of the liver is accompanied by the same changes that occur after injury and many acute illnesses: decreased fibrinolytic activity and increased levels of fibrinogen and α_1-antitrypsin. Also, previous findings of reduced fibrinolytic activity and increased fibrinogen levels in cases of primary biliary cirrhosis are confirmed.

3529 LIVER CIRRHOSIS: IMMUNOFLUORESCENCE AND BIOCHEMICAL STUDIES DEMONSTRATE TWO TYPES OF COLLAGEN. *(E.)* Gay, S.; Fietzek, P. P.; Remberger, K.; Eder, M.; Kuhn, K. (Max-Planck Inst. Biochem., Munich, Germany). *Klin. Wochenschr.* 53(5): 205-208, 1975.

The collagen synthesized by small- and large-noduled liver cirrhoses was characterized immunohistologically and biochemically. The collagen was prepared from the livers of a 51-yr-old woman with small-noduled liver cirrhosis and a 73-yr-old man with large-noduled liver cirrhosis and liver carcinoma of both hepatocellular and cholangiocellular type. The fibrous septa of both livers showed specific fluorescence with anti-type III collagen antibodies, as did the fibrosing septa of the cholangiocellular liver carcinoma. No fluorescence was seen with anti-type I and II collagen antibodies or normal serum. Pepsin solubilization of the cirrhotic livers yielded two fractions: 40% of the total collagen precipitated at 1.5 M NaCl, and 60% precipated at 2.5 M NaCl. The 1.5 M NaCl precipitate was classified as type III collagen according to its electron microscope characteristics, chromatographic behavior, and pattern of CNBr peptide. Although the 2.5 M NaCl precipitate appeared to be type I collagen under the electron microscope, no reaction could be obtained with anti-type I antibodies and the chromatographic behavior was different from that of type I collagen isolated from the skin. Tne results suggest an increased rate of biosynthesis of both types of collagen under pathological conditions. The increased type III collagen in the cirrhotic livers was due to hepatic cell necrosis and increased synthesis in the periductular and portal area; the 2.5 M NaCl precipitate was apparently synthesized in the proliferating fibroblasts in the portal tracts. The process of polymerization and possible pathological cross-linking of collagen fibrils may be initiated and enhanced by substances from necrotic hepatocytes; therefore, the balance of interaction between epithelial and mesenchymal cells might be disturbed.

3530 SPONTANEOUS REVERSAL OF PORTAL BLOOD FLOW: THE CASE FOR AND AGAINST ITS OCCURRENCE IN PATIENTS WITH CIRRHOSIS OF THE LIVER. *(E.)* Moreno, A. H.; Burchell, A. R.; Reddy, R. V.; Steen, J. A.; Panke, W. F.; Nealon, T. F. (St. Vincent's Hosp., New York, N.Y.). *Ann. Surg.* 181(3):346-358, 1975.

An analysis was made of the evidence for and against the occurrence of spontaneous reversal of portal flow in cirrhosis of the liver. The evidence examined was obtained from an extensive review of the literature including manometric studies, radioactive tracer studies, radiologic studies, and actual measurements of magnitude and direction of portal blood flow. A physical analysis of manometric studies demonstrated that the occluded portal pressures could not be used to construct a hydraulic gradient for portal flow. The evidence derived from radioactive tracer and radiologic studies was also examined and found weak, with conflicting results in the radiologic studies. Actual measurements of magnitude and direction of portal flow provided impressive evidence against the occurrence of spontaneous reversal of portal flow in cirrhosis. The findings suggest that unless new and convincing evidence is provided, it may not serve the best interests of medicine and of patients to continue accepting the unproven phenomenon of spontaneous reversal of portal flow in cirrhosis.

3531 PORTACAVAL SHUNT IN FOUR PATIENTS WITH HOMOZYGOUS HYPERCHOLESTEROLAEMIA. *(E.)* Stein, E. A.; Mieny, C.; Spitz, L.; Saaron, I.; Pettifor, J.; Heimann, K. W.; Bersohn, I.; Dinner, M. (South African Inst. Med. Res., Johannesburg). *Lancet* 1(7911):832-835, 1975.

The early results of portacaval shunt in four patients with homozygous hyperbetalipoproteinemia are described. The patients, all of whom proved resistant to intensive dietary and drug therapy, were a 7-yr-old boy, a 27-yr-old man, a 16-yr-old girl, and a 10-yr-old boy. Prior to portacaval shunt, all patients were removed from medical treatment and submitted to total parenteral alimentation. During the first 2 weeks they were given a casein hydrolysate, dextrose, electrolyte, and vitamin infusion; during the third week, this was supplemented with infusion of a fat emulsion, the fat content of which was gradually increased to 2 g/kg. End-to-end portacaval shunt was performed at the end of the third week. During the period of parenteral alimentation, the serum cholesterol decreased significantly in all four patients, although during the administration of the fat emulsion, one patient experienced a rise in cholesterol. Postoperatively, the size of xanthomas decreased in all cases; the serum cholesterol levels rose above those achieved during hyperalimentation, and this rise continued for up to 3 months before further reductions were observed. Postoperative triglyceride levels were normal in all patients, and in most patients, bruits decreased in intensity. Improvements in patients with angina were considerable. None of the patients experienced any ill-effects postoperatively. The results indicate that it would be premature to consider all patients with homozygous hypercholesterolemia for portacaval shunt.

3532 SULFATION AND RENAL EXCRETION OF BILE SALTS IN PATIENTS WITH CIRRHOSIS OF THE LIVER. *(E.)* Stiehl, A.; Earnest, D. L.; Admirand, W. H. (San Francisco Gen. Hosp., Calif.). *Gastroenterology* 68(3):534-544, 1975.

Bile salt sulfation was evaluated in 17 patients with cirrhosis of the liver to determine the importance of that metabolic pathway. Analyses were made of sulfated and nonsulfated free and glycine or taurine-conjugated bile salts in serum, urine, and bile. Gas-liquid chromatography, isotopic studies, and infrared spectroscopy were also carried out. Of the urinary bile salts, 56% were sulfated: 24% of the cholate, 76% of the chenodeoxycholate, 85% of the deoxycholate, and 100% of the lithocholate. Neither sulfated nor nonsulfated bile salts could be detected in urine from two normal subjects. Of bile salts synthesized in the liver, 3-12% were excreted in urine. Sulfated bile salts represented 4-5% of the total bile salts in serum and 7-10% of the total bile salts in bile. Approximately 95% of both sulfated and nonsulfated bile salts in serum, urine, and bile were conjugated with glycine and taurine. Renal clearance of cholate was more than 3 times greater than that of chenodeoxycholate or deoxycholate. Renal clearance of sulfated bile salts was 20-200 times greater than that of the corresponding nonsulfated bile salts. With the exception of serum bilirubin, no direct correlation was found between severity of liver disease and concentrations of bile salts in peripheral blood. The results demonstrate sulfation of bile salts in patients with cirrhosis and the excretion of the sulfated compounds in urine.

3533 LIVER FAILURE AFTER JEJUNOILEAL SHUNT. *(E.)* Andrassay, R. J.; Haff, R. C.; Lobritz, R. W. (Wilford Hall US Air Force Med. Cent., Lackland Air Force Base, Texas). *Arch. Surg.* 110(3): 332-334, 1975.

An unusual case of liver failure resulting from a jejunoileal shunt is presented. A 41-yr-old woman underwent jejunoileal bypass for morbid obesity, with 35.6 cm of jejunum distal to the ligament of Treitz anastomosed end-to-end to 10.2 cm of ileum proximal to the ileocecal valve. Preoperative evaluation showed normal liver scan, liver function and BSP test results. About 1 yr later she was hospitalized for polyarthritis of unknown etiology. Liver function tests showed elevated alkaline phosphatase (27 King-Armstrong U/100 ml) and serum glutamic oxaloacetic transaminase (153 mμ/ml) values. Liver biopsy showed severe fatty infiltration, marked portal fibrosis with entrapment of hepatocytes, and portal triaditis. Hepatocytic necrosis was seen in some areas. After a month the polyarthritis had spontaneously cleared, but liver function tests showed an elevated level of alkaline phosphatase (320 IU), and elevated levels of SGOT (150 mμ/ml), lactic dehydrogenase (210 IU/liter), creatine phosphokinase (25 IU), and bilirubin (0.8 mg/100 ml). Surgery was performed and normal intestinal anatomy restored. Liver function values returned to normal within 2 months. Biopsy showed complete resolution of the fatty infiltration and

hepatocytic necrosis. The case supports the previously proposed potential hazard of liver damage after ileojejunal bypass. It is suggested that these patients be maintained on a high protein and vitamin supplemented diet with avoidance of alcohol, and be kept under close observation for at least 2 yr after surgery.

3534 CLINICAL PHYSIOLOGIC APPROACH TO THE PATIENT WITH PORTAL HYPERTENSION. *(E.)* Chiandussi, L. (Univ. Turin, Italy). *Bull. NY Acad. Sci.* 51(4);557-564, 1975.

Some of the major problems which are encountered in connection with the new techniques available for the clinical investigation of portal hypertension are reviewed. These techniques include direct catheterization of the left branch of the portal vein *via* the round ligament of the liver, catheterization of the celiac trunk and the superior mesenteric artery, and simultaneous catheterization of a main hepatic vein and the left branch of the portal vein. Portal hypertension may arise from thrombosis of the portal vein (extrahepatic portal hypertension), partial occlusion of the hepatic veins (Budd-Chiari syndrome), or, most frequently, intrahepatic block (intrahepatic portal hypertension). Intrahepatic portal hypertension can occur as the result of postsinusoidal block (e.g., veno-occlusive disease, alcoholic hepatitis), intrahepatic block (e.g., cirrhosis, Wilson's disease), or presinusoidal and sinusoidal block (e.g., steatosis, tumors, schistosomiasis, infiltrative diseases, obliterative portal venopathy). Direct catheterization of the portal vein and catheterization of the celiac trunk and the superior mesenteric artery have also contributed to the diagnosis and clinical study of patients with portal hypertension. For example, there is evidence that diversion of portal blood from the liver influences hepatic function and, therefore, survival; the development of reliable methods for the preoperative determination of portal flow in intact patients makes it possible to test this hypothesis by large-scale prospective, controlled studies. Multicentric prospective controlled studied are also needed for: the determination of the survival rate and incidence of encephalopathy in cirrhotics who undergo distal or selective shunt or end-to-side portacaval shunt; the critical evaluation of the medical management of bleeding esophageal varices; and evaluation of the modified Sengstaken-Blackemore tube and the continous infusion of vasopressin or felypressin into the superior mesenteric artery.

3535 CHILDHOOD CRYPTOGENIC CIRRHOSIS AND ANTIMICROSOMAL ANTIBODIES: A NEW SEROLOGICAL MARKER? *(Fr.)* Joannard, A.; Bost, M.; Micouin, C.; Bensa, J. C.; Varloteaux, C.; Beaudoing, A. (Univ. Hosp. Ctr., Grenoble, France). *Pediatrie* 29(6):607-613, 1974.

A 10-yr-old girl, who had been in good health, developed jaundice and signs of portal hypertension when she was hospitalized with pneumococcal pneumonia. Liver function was severely disturbed, and there were signs of hypersplenism. In addition to hypergammaglobulinemia, the IgG concentration was very high (40 g/liter) and the IgA concentration very low (0.30 g/liter). Antimicrosomal antibodies for the liver and kidneys were detected in high titers (1/1000) in the serum by indirect immunofluorescence; they were also present in ascites fluid, but in lower titers. Radiological examinations revealed esophageal varices, and the portal pressure was 50 cm H_2O; no evidence of a prehepatic block was found. At laparoscopy a diagnosis of macronodular cirrhosis was confirmed. A splenectomy was performed in conjunction with an end-to-side portacaval anastomosis 21 days after onset of symptoms. For 6 months after surgery the patient received decreasing doses of corticosteroids. Serum protein levels improved together with improvements in the clinical and biological findings; antimicrosomal antibody titers decreased to 1/200. When corticosteroids were discontinued for 9.5 months, the patient again developed ascites and jaundice, biological findings became abnormal, and antimicrosomal antibody titers increased to 1/1000. Since diuretics and corticosteroids have been reinstituted, all biological findings have improved with the exception of serum alkaline phosphatase levels. Antimicrosomal antibody titers have decreased to less than 1/10. These autoantibodies are relatively rare and have been previously reported in high titers only in 11 young patients with chronic active hepatitis, 15 with various liver diseases, and 6 with extrahepatic or undiagnosed diseases.

3536 CONNECTIVE TISSUE ALKALINE PHOSPHATASE IN THE SERUM: A CRITERION OF THE ACTIVITY OF CHRONIC LIVER DISEASES. *(Ger.)* Liebe, S.; Petzold, H.; Rogos, R. (Dep. Med., Karl Marx Univ., Leipzig, Germany). *Dtsch. Z. Verdau. Stoffwechselkr.* 34(1): 23-26, 1974.

After dialyzing 20 µl serum against potassium phosphate buffer (0.01 M, pH 7.2) and adding 100 µl of a 20% aqueous sucrose solution, isoenzymes of alkaline phosphatase were separated by electrophoresis in 7% polyacrylamide gel. These studies were performed on fasting sera from 21 patients with cirrhosis and seven patients with chronic aggressive hepatitis undergoing transformation into cirrhosis. Small intestine alkaline phosphatase was detected in sera from 1/2 of these patients, but another isoenzyme, whose electrophoretic mobility was intermediate between that of hepatic and small intestine phosphatases, was present in sera from 2/3 of all patients. In some sera, the latter component was found in combination with the small intestine isoenzyme, while in others, it occurred alone. This isoenzyme has not previously been described in sera from patients with liver disease. Although some literature reports have indicated that this is bone alkaline phosphatase, none of the patients studied had any evidence of skeletal disease. This isoenzyme occurred only in sera from patients whose liver biopsies had strong alkaline phosphatase reactions in the connective tissue. This suggests that the intermediate isoenzyme originates in active connective tissue in the liver, passes over into the serum, and can be detected there by electrophoresis. Since connective tissue proliferation is regarded as a criterion for the activity of cirrhosis, the de-

tection of connective tissue phosphatase in the serum can be considered indirect evidence of active cirrhosis.

3537 PLASMA PHOSPHATIDE PATTERN IN ACUTE AND CHRONIC LIVER DISEASE. *(Ger.)* Jipp, P.; Ravens, K. G.; Salm, M. (Med. Clin., Univ. Kiel, Germany). *Klin. Wochenschr.* 52(16):759-762, 1974.

Total phospholipid concentrations and the concentrations of lysolecithin, sphingomyelin, lecithin, and phosphatidylethanolamine were determined by thin-layer chromatography in plasma from 18 patients (eight women and 10 men; mean age 45 yr) with acute hepatitis; 37 patients (13 women and 24 men; mean age 57 yr) with cirrhosis; 10 patients (one woman and nine men; mean age 44 yr) with fatty liver and 30 normal controls (11 women and 19 men; mean age 40 yr). Except for an increase in the mean concentration of phosphatidylethanolamine, the phospholipid pattern was normal in patients with fatty liver. While no significant difference was found between the mean concentrations of total plasma phospholipids in cirrhotics and controls, the mean lysolecithin concentration was decreased and the mean phosphatidylethanolamine concentration increased in cirrhosis. Two weeks after the onset of acute hepatitis, the mean concentrations of total phospholipids, sphingomyelin, lecithin, and phosphatidylethanolamine were increased and the mean concentration of lysolecithin was decreased. No correlations were found between changes in phospholipid levels and the results of liver function tests. The lysolecithin: lecithin ratio was significantly lower in patients with acute hepatitis and cirrhosis than in controls. Differences in changes occurring in lecithin and lysolecithin are considered to be the result of a decrease in lecithin-cholesterol acyl transferase activity.

3538 CLINICAL STUDY ON THE COMPETITIVE HEPATIC EXCRETION OF BILIRUBIN AND SULFOBROMOPHTHALEIN. *(Sp.)* Alves, J.; Santolaria, F.; Cabarcos, A.; Huguet, R.; Bruguera, J. A.; Liso, P. (Fac. Med., Univ. Navarra, Pamplona, Spain). *Rev. Esp. Enferm. Apar. Dig.* 44(7):687-696, 1974.

The 45-min BSP retention test was performed on five patients with liver disease and nine controls by slow i. v. injection of 5 mg/kg BSP. Bilirubin levels were measured before injection of BSP and 72 hr later. These studies were performed on one patient with extrahepatic obstructive jaundice, two with alcoholic cirrhosis, one with chronic aggressive hepatitis, and one with cryptogenic cirrhosis. In the patient with extrahepatic obstructive jaundice, injection of BSP increased total serum bilirubin levels by 36.8% (36.8% for direct, 38.4% for indirect). In contrast, no appreciable change occurred in serum bilirubin levels in the other four patients with liver disease, whether they were jaundiced or not, or in the controls. No correlations were found between increases in bilirubin levels, when they occurred, and the initial bilirubin values in jaundiced patients, the degree of hepatomegaly, or the results of liver function tests. In extrahepatic obstructive jaundice, increases in serum BSP and bilirubin levels are due to competition between these two substances in the hepatocytes. In patients with intrahepatic disease, the liver has lost its ability to conjugate and transport BSP but not bilirubin.

3539 α_1-ANTITRYPSIN DEFICIENCY IN INFANTS: CLINICAL, BIOCHEMICAL, MORPHOLOGICAL, IMMUNOHISTOCHEMICAL, AND GENETIC FINDINGS IN TWO INFANTS. *(Ger.)* Exss, R.; Rotthauwe, H. W.; Schattenberg, P. J.; Totovic, V.; Muller, R.; Sennekamp, J.; Benkmann, H. G.; Goedde, H. S. (Pediatr. Clin., Univ. Bonn, Germany). *Dtsch. Med. Wochenschr.* 100(6):222-228, 1975.

Case reports are presented for two infants who developed cholestatic jaundice by age 3 and 6 weeks, resp. Examination of liver biopsies showed the presence of globular eosinophilic inclusions in the cytoplasm of many parenchymal cells and perilobular fibrosis. The inclusions gave a positive reaction with PAS reagent, were diastase-resistant, and stained selectively with fluorescein-labeled rabbit antihuman α_1-antitrypsin. Under the electron microscope, these deposits of α_1-antitrypsin appeared to be amorphous material in dilated cisternae of the endoplasmic reticulum. Family studies of serum α_1-antitrypsin levels showed that both infants were homozygous for the protease inhibitor (Pi) gene. In one case, the patient's father and paternal aunt were also homozygotes, while the mother, paternal grandparents, and maternal grandmother were heterozygotes. In the other case, the parents, paternal grandmother, and maternal grandfather were heterozygotes. These findings are consistent with an autosomal codominant inheritance. Except for slight hepatomegaly, neither patient had clinical symptoms at age 1 yr. However, serum transaminase and γ-glutamyl transpeptidase levels remain slightly elevated.

3540 DEFECTIVE REGULATION OF CHEMOTAXIS IN CIRRHOSIS. *(E.)* Maderazo, E. G.; Ward, P. A.; Quintiliani, R. (Hartford Hosp., Connenticut). *J. Lab. Clin. Med.* 85(4):621-630, 1975.

The possibility of a chemotactic defect was investigated in 11 cirrhosis and three hepatitis patients. All the cirrhotic patients had a history of excessive alcohol intake, and presented with muscular wasting, icterus, and ascites. Serum albumin ranged from 2.0-3.1 g% and total bilirubin from 2.9-16.0 mg%. The three hepatitis patients had acute hepatitis believed to be caused, resp., by alcohol, halothane, and methimazole. Serum transaminase levels ranged from 113-1850 U/dl, serum albumin from 3.5-4.4 g%, and total bilirubin from 0.4-12.8 mg%. Neutrophils were obtained by sedimentation of heparinized blood in an equal volume of 6% dextran in phosphate buffered saline, low speed centrifugation, and resuspension in medium 199. Chemotactic assays were performed. Sera were also ultracentrifuged and assayed for chemotactic factor inactivator. For controls, neutrophils and sera of healthy adults were assayed. Two of the cirrhotic sera reduced chemotactic ac-

tivity by 64% and 90% while control serum caused no fall in activity. Nine of the cirrhotic sera reduced activity 97-99% while alcoholic hepatitis serum reduced it only 17% and control serum produced no inactivation. Serum from a patient with juvenile cirrhosis associated with α_1-antitrypsin deficiency showed 36% inactivation, while sera from the halothane and methimazole-induced hepatitis showed little or none. These chemotactic defects were seen only when normal or cirrhotic neutrophils were suspended in the presence of cirrhotic serum. To distinguish between the inhibitory effect of cirrhotic serum on neutrophils as opposed to chemotactic factors, cirrhotic serum was incubated with bacterial chemotactic factor, and then heat-inactivated. Other sera were heat-inactivated first, and then incubated. Using normal neutrophils, it was found that unheated cirrhotic, but not normal serum, would inactivate the chemotactic factor, while the preheated serum lost its inactivating power. Comparison of bacterial chemotactic factor with C3 and C5 fragments, showed that all three factors were inactivated by cirrhotic serum. Ultracentrifugation showed that chemotactic factor inactivator activity appeared between the albumin and cytochrome markers in seven cirrhotic sera, while in three others a small zone of activity was near the IgG marker. In three more, activity peaked only in the upper zone of the gradients. Incubation with zymosan showed generation of significantly less chemotactic activity in cirrhotic than normal sera. It is concluded that in cirrhotic patients there is a chemotactic defect, associated with the serum but not the leukocytes, which is attributable to supernormal levels of chemotactic factor inactivator.

3541 CIRRHOSIS IN A PATIENT WITH α_1-ANTITRYPSIN DEFICIENCY. AN ULTRASTRUCTURAL AND IMMUNOCYTOCHEMICAL STUDY. *(Fr.)* Geffroy, Y.; Colin, R.; Martin, J. P.; Feldmann, G.; Hemet, J.; Joram, F. (Charles Nicolle Hosp., Rouen, France). *Arch. Fr. Mal. App. Dig.* 63:495-502, 1974.

3542 ANTIBODIES AGAINST SOME BACTERIAL AND NONBACTERIAL ANTIGENS IN CHRONIC HEPATITIS AND CIRRHOSIS. *(Cz.)* Petera, V.; Zavazal, V.; Vosmik, J. (Med. Fac., Charles Univ., Plzen, Czechoslovakia). *Cas. Lek. Cesk.* 113(42):1287-1289, 1974.

3543 STATISTICAL ANALYSIS OF SOME CLINICAL AND BLOOD CHEMISTRY PARAMETERS IN 100 PATIENTS WITH CIRRHOSIS. *(It.)* Scanni, A.; Ferrari, P.; Bianchi, A. E. (Ciceri-Agnesi Hosp. Fatebenefratelli Fatebenesorelle, Milan, Italy). *Fegato* 19(3):626-634, 1973.

3544 DETERMINATION OF SPECIFIC HEPATIC BLOOD FLOW USING ^{133}Xe AND ^{85m}Kr WITH AN INHALATION TECHNIQUE. *(Ger.)* Schmitz-Feuerhake, I.; Huchzermeyer, H.; Frohlich, H.; Reblin, T. (Med. Coll., Hannover, Germany). *Z. Gastroenterol.* 12(Suppl.):405, 1974.

3545 PHAGOCYTIC FUNCTION OF THE SPLEEN IN CHRONIC DISEASES OF THE LIVER. *(Rus.)* Novopashennaia, V. V. (Kiev Inst. Postgrad. Med., USSR). *Vrach. Delo* (10):23-26, 1974.

3546 STATE OF THE PHYSICO-CHEMICAL PROPERTIES OF BILE IN LIVER CIRRHOSIS. *(Rus.)* Khvorostinka, V. N. (S. M. Kirov Acad. Mil. Med., Leningrad, USSR). *Vrach. Delo* (10):27-31, 1974.

3547 BILE ACIDS IN THE SERUM AND URINE OF PATIENTS WITH DECOMPENSATED LIVER CIRRHOSIS. *(Ger.)* Wildgrube, H. J.; Dittman, K.; Erb, W. (Cent. Intern. Med., Univ. Frankfurt/Main, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:953-954, 1973.

3548 CHANGES IN GASTRIN, DETERMINED RADIOIMMUNOLOGICALLY AFTER STIMULATION, IN PATIENTS WITH CIRRHOSIS. *(Ger.)* von Berger, L.; Raptis, S.; Wannagat, L.; Pfeiffer, E. F. (Cent. Intern. Med. Pediatr., Univ. Ulm, Germany). *Z. Gastroenterol.* 12(suppl.):416-417, 1974.

3549 POSTHEPARIN DIAMINE OXIDASE (HISTAMINASE) IN ACUTE AND CHRONIC LIVER DISEASE. *(Ger.)* Gang, V. (Med. Clin., Univ. Wurzburg, Germany). *Z. Gastroenterol.* 12(suppl.):407-408, 1974.

3550 STUDY OF CELLULAR IMMUNITY IN CIRRHOTICS USING THE NATURAL ROSETTE TEST. *(Fr.)* Dubois, J. B.; Serrou, B.; Bert, J. M.; Balmes, J. L. (Saint Eloi Hosp., Montepellier, France). *Rev. Fr. Gastroenterol.* (95):17-18, 21-22, 24, 27, 1974.

3551 SCLEROSING OF THE ESOPHAGEAL WALL IN THE TREATMENT OF ACUTE BLEEDING FROM ESOPHAGEAL VARICES AND THREATENED BLEEDING WITH DECOMPENSATED LIVER FUNCTION. *(Ger.)* Paquet, K. J.: Engel, C. (Surg. Clin., Univ. Bonn, Germany). *Z. Gastroenterol.* 12(Suppl.):395-399, 1974.

3552 LONG-TERM SILYMARIN THERAPY FOR OUTPATIENT CIRRHOTICS. *(Ger.)* Benda, L.; Zenz, W. (Floridsdorf Munic. Hosp., Vienna, Austria). *Therapiewoche* 24(38):3598-3600, 3603-3606, 3608, 1974.

3553 THE ROLE OF RENO-PORTAL ANASTOMOSIS IN THE SURGICAL TREATMENT OF PORTAL HYPERTENSION WITH A REPORT OF 21 ORIGINAL CASES. *(It.)* Saubier, E. C.; Brault, J. A.; Russo, A.; Partensky, C. (Edouard Herriot Hosp., Lyon, France). *Chir. Gastroenterol.* 8(2):196-213, 1974.

3554 THE MOTOR FUNCTION OF THE SMALL INTESTINE IN PORTAL HYPERTENSION AND AFTER ITS CORRECTION. *(Rus.)* Eremenko, V. P.; Kataeva, G. A.; Zykov, L. I. (S. M. Kirov Acad. Mil. Med., Leningrad, USSR). *Klin. Med. (Mosk.)* 51(11):88-95, 1973.

3555 CLINICAL FINDINGS DURING CATHERIZATION OF THE SUPERIOR HEPATIC VEINS. *(It.)* Mattioli, F.; Torre, G. C. (Inst. Clin. Surg. Ther. I, Univ. Genoa, Italy). *Chir. Gastroenterol.* 8(1):58-78, 1974.

3556 PRIMARY BILIARY CIRRHOSIS AND SCLERODERMA. *(E.)* August, P. J. (St. Thomas' Hosp., London, England). *Proc. R. Soc. Med.* 67(12):1238-1239, 1974.

3557 PLASMA AMINO ACID PROFILES OF PORTACAVAL SHUNTED HUMANS COMPARED TO LABORATORY RODENT MODELS. *(E.)* Hupp, J.; Brown, H. (Boston City Hosp., Mass.). *Fed. Proc.* 34(3):394, 1975.

3558 END-TO-SIDE SPLENORENAL SHUNT FOR TREATMENT OF PORTAL HYPERTENSION. *(E.)* Gill, S. S.; Eggleston, F. C.; Singh, C. M. (Christian Med. Coll., Punjab, India). *Arch. Surg.* 110(3):254-257, 1975.

3559 LIVER FUNCTION, AGE AND PORTASYSTEMIC ENCEPHALOPATHY. *(E.)* Kardel, T. (Gentofte Hosp., Copenhagen, Denmark). *Neth. J. Med.* 17(2):50-53, 1974.

3560 CURRENT CONCEPTS RELATING TO METABOLIC CHANGES AFTER PORTACAVAL SHUNTS, AND ALCOHOL AND THE PANCREAS. (1) PORTACAVAL SHUNTS. *(E.)* Hicknam, R.; Crosier, J. H.; Meyers, O. L.; Engelbrecht, G. H. C.; Keraan, M.; Immelman, E. J.; Terblanche, J. (Dep. Surg. Med., Univ. Cape Town, South Africa). *S. Afr. J. Surg.* 12(4):201-202, 1974.

3561 SURGERY AND PROGNOSIS OF PREHEPATIC PORTAL HYPERTENSION. *(E.)* Rapant, V.; Kralik, J. (Univ. Surg. Clin., Olomouc, Czechoslovakia). *Int. Surg.* 60(3):144-149, 1975.

3562 SOME ASPECTS OF ^{35}S-METHIONINE METABOLISM IN HEPATIC CIRRHOSIS. *(E.)* Szantay, J.; Szirmai, E.; Cotul, S. (Dep. Int. Med., Univ. Cluj, Roumania). *Mater. Med. Pol.* 6(2):120-122, 1974.

3563 TRENDS IN MORTALITY DUE TO CIRRHOSIS OF THE LIVER IN ALLEGHENY COUNTY - COMPARISON WITH BALTIMORE, MARYLAND. *(E.)* Kuller, L. H.; Perper, J. A.; Hersherson, S. (Grad. Sch. Public Health, Univ. Pittsburgh, Pa.). *Pa. Med.* 78(4):61-65, 1975.

3564 SERUM GASTRIN IN PATIENTS WITH CIRRHOSIS OF THE LIVER. *(E.)* Mazzacca, G.; Budillon, G.; De Marco, F.; De Ritis, F. (2nd Sch. Med., Univ. Naples, Italy). *Digestion* 11(3/4):232-239, 1974.

See also, 2664, 2863, 2890, 2922, 2930, 2931, 2932, 2960, 3000, 3344, 3352, 3361, 3368, 3387, 3488, 3490, 3491, 3493, 3496, 3751.

LIVER AND BILIARY TRACT

Gallbladder and Biliary Tract Diseases

3565 DISSOLUTION OF STONES IN THE COMMON BILE DUCT WITH BILE-SALT SOLUTIONS. *(E.)* Tcouli, J.; Jablonski, P.; Watts, J. M. (Prince Henry's Hosp., Monash Univ., Melbourne, Australia). *Aust. NZ J. Surg.* 44(4):336-340, 1974.

A method is presented for treatment of common bile duct stones discovered after surgical exploration. Retained stones were found in the common bile duct of 14 post-cholecystectomy and two post-cholecystostomy patients treated for acute cholecystitis with removal of the gallbladder stones. Treatment consisted of infusion through the indwelling T-tube or cholecystostomy tube of sterile bile salt solution at 4-6 ml/hr for 10 days. Nine of the patients received an infusion of 200 mM sodium taurocholate, and the other seven received 200 mM sodium cholate. Cholestyramine (4 g) was given p.o. every 6 hr during infusion. If cholangiography revealed improvement after 10 days, treatment was continued, otherwise it was stopped. Stones disappeared in 12 patients, were reduced in size by 1/3 in one, and were unchanged in three. Of these three, one was unable to tolerate the cholestyramine and developed diarrhea; the remaining two were the cholecystostomy patients. In one of these, proper infusion could not be achieved due to leakage around the infusion catheter. In the other the stone may have been of insoluble pigment rather than cholesterol. Side effects included diarrhea (two patients), biliary pain (3), and pyrexia and chills in one. It is concluded that this method is effective and should be attempted before surgical re-exploration is considered.

3566 ENDOSCOPY OF THE BILE DUCT: AN EVALUATION. *(E.)* Leslie, D. (R. Melbourne Hosp., Australia). *Aust. NZ J. Surg.* 44(4):340-342, 1974.

The use of endoscopy in 504 biliary tract operations is reviewed. Of 5 types of instruments (2 types of Sass Wolf, 2 types of Storz, and 1 A.C.M.I. flexible model) the Storz models were the most effective. The A.C.M.I. had poor image and depth of focus, and disorientation occurred as a result of torsion. The Storz models were narrower, more efficient, and had better accessories than the Sass Wolf models. The instrument proved useful in determining patency of the duodenal papilla and in removal of residual stones under visual control. Residual stones were removed in 22% of the patients. Endoscopy was also useful in removal of awkward stones, demonstration of anatomical abnormalities, and discovery of latent pathological lesions such as papillomata, pancreatic carcinoma, fibrosis or edema of the papilla, and cholangitis. Mortality was negligible and in no case did choledochoscopy contribute to cause of death. Wound infection rate was the same as for cholecystectomy with no common bile duct exploration (6%). Operative cholangiography was found to be useful in determining necessity of exploration of

the duct. However, 11 of 91 explorations proved to be unnecessary. It is concluded that choledochoscopy is safe, has more to offer than cholangiography, and should be routinely performed after cholangiography.

3567 BONE DISEASE IN INFANTS WITH PROLONGED OBSTRUCTIVE JAUNDICE. *(E.)* Thomas, P. S.; Glasgow, J. F. T. (R. Belfast Hosp. Sick Child., Northern Ireland). *Pediatr. Radiol.* 2(2):125-132, 1974.

Four cases of infants with obstructive jaundice associated with rickets are presented. One case was of intrahepatic cholestasis present from birth, and decreased slowly in severity over 4 weeks without specific treatment. Marked decalcification of the bones was noted 2 weeks after discharge from the hospital. The second case had obstructive jaundice from birth associated with Rhesus isoimmunization. The liver and spleen were enlarged. At 4 months, x-rays showed mild rachitic changes of the wrists and knees. Oral phenobarbitone decreased serum bilirubin level to normal; however, the rachitic changes became more pronounced. Large doses of vitamin D subsequently corrected this and growth became normal. In the third case, jaundice from complete obstruction was noted soon after birth. Laparotomy disclosed extrahepatic biliary atresia. Skeletal x-rays showed lucent zones at the long bone metaphyses and encircling the round bones, presumably due to growth arrest. Vitamin D therapy was begun at 7 weeks of age, but the bony changes were slow to heal and growth remained poor. In the last case, jaundice was noted at 4 weeks of age, and laparotomy disclosed extrahepatic biliary atresia. Rachitic rosary and frontal bossing were noted. Vitamin D therapy was not begun until 13 months of age, and gross limb disease and permanent deformity resulted. Because of the differing etiology of the jaundice in the four infants, it is suggested that reduced bile salts in the intestine may be the major etiological factor in the development of the rickets. Because the severity of the rickets was directly related to the amount of time before vitamin D therapy was begun, it is suggested that infants with jaundice be given prophylactic doses of fat soluble vitamins.

3568 DUODENAL BILE ACIDS AFTER A TEST MEAL. *(E.)* Fausa, O. (Rikshosp., Oslo, Norway). *Scand. J. Gastroenterol.* 9(6):567-570, 1974.

Bile acids in duodenal aspirates after test meal stimulation of gallbladder emptying were examined in 12 healthy volunteers (4 women and 8 men, ranging in age from 20-46 yr), using a purified 3α-hydroxysteroid dehydrogenase for the quantitative determination. An average total bile acid concentration of 14.5 μM/ml (range 5.8-39.6) was found. All bile acids were conjugated, the mean ratio of glycine-conjugated to taurine-conjugated bile acids being 3.2. The bile acids were conjugated in the same proportions with glycine and taurine. Expressing the relative proportions of the 3 major bile acids as % of the total, the average value for cholic acid was 40% (range 25-50), chenodeoxycholic 40% (range 30-52), and deoxycholic 20% (range 10-35). These results are in agreement with previously published findings, in which varying methods for gallbladder emptying and for bile acid separation and quantification were used. It is concluded that the method using a purified 3α-hydroxy-steroid dehydrogenase may advantageously be used in the study of duodenal bile acids.

3569 THE INCIDENCE OF SECONDARY COMMON BILE DUCT EXPLORATION. *(E.)* Duff, J. H.; Salvian, A. G.; Finley, R. (Victoria Hosp., London, Canada). *Surg. Gynecol. Obstet.* 139(5):723-725, 1974.

A retrospective analysis was carried out of all secondary common bile duct explorations done at 2 major teaching hospitals in London, Canada during a period of 15 yr to determine the incidence of secondary common bile duct exploration, and to see if the incidence varies with the method of the primary procedure. A total of 112 patients had a secondary common bile duct exploration during the 10-yr period from 1963-1972. At least 1/3 of the patients (46 of 112) already had a common bile duct exploration at the time of cholecystectomy. In these hospitals, 36% of the patients undergoing cholecystectomy have an operative cholangiogram, 13.6% have common duct exploration and 55.2% have cholecystectomy alone. When the group of 112 patients undergoing secondary common bile duct exploration was subdivided according to the method of the initial prodedure, the lowest incidence of secondary common bile duct exploration occurred in patients having operative cholangiograms with cholecystectomy, 0.3-1.0%, and the highest, in those who initially had cholecystectomy and common bile duct exploration, 3.8-5.3%. For cholecystectomy alone, the incidence was 1.2-1.9%. These findings support the selective use of cholangiography with cholecystectomy, although the benefits are small in terms of percent reduction in the incidence of secondary common bile duct exploration. Operative cholangiography may be useful, however, in reducing the number of negative findings at common bile duct exploration performed on the basis of clinical criteria. This is of significant benefit because the frequency of finding stones in the common duct seldom has been above 50%. There was little evidence for the view that performance of a cholangiogram is mandatory with every cholecystectomy. The patients at greatest risk of having retained stones and requiring secondary common bile duct exploration are those who undergo cholecystectomy and common bile exploration as the initial procedure.

3570 CANALICULAR BILE PRODUCTION IN MAN. *(E.)* Prandi, D.; Erlinger, S.; Glasinovic, J. C.; Dumont, M. (INSERM, Beaujon Hosp., Clichy, France). *Eur. J. Clin. Invest.* 5(1):1-6, 1975.

Bile flow, erythritol clearance and bile acid excretion were studied in eight non-icteric patients, aged 47-83 yr, operated upon for gallstone disease without biliary obstruction and in whom T-tubes had been inserted. Bile flow increased from the second (0.27 ml/min) to the seventh (0.50 ml/min) postoperative days and remained stable thereafter. Because the values obtained between the seventh and the 15th postoperative days (average 0.46 ml/min) were not lower and were of the same order of magnitude as those previously reported in the literature for quantitative bile collections, it was assumed that bile collection had been complete. Bile:plasma concentration ratio of erythritol, measured following a single i.v. injection and during constant i.v. infusion of ^{14}C-erythritol, was 0.77. The regression line between erythritol clearance and bile flow had a slope of 0.99 (indicating that increments in clearance were followed by equivalent increments of flow) and an intercept for a zero-clearance of 0.11, suggesting a ductular/ductal secretion of 0.11 ml/min. The relationship between erythritol clearance and bile acid excretion suggested that canalicular bile was formed both of a bile acid-dependent flow (11 µl of water being excreted per µM of bile acid secreted) and a bile acid-independent flow of 0.16 ml/min (or 35% of the average bile flow). These findings indicate that erythritol clearance provides a valid estimate of canalicular bile flow in man and that the three bile fractions previously postulated in animals (canalicular bile acid-dependent, canalicular bile acid-independent and ductular/ductal) may also be present in man.

3571 TREATMENT OF GALLSTONES WITH CHENODEOXYCHOLIC ACID AND PHENOBARBITAL. *(E.)* Coyne, M. J.; Bonorris, G. G.; Chung, A.; Goldstein, L. I.; Lahana, D.; Schoenfield, L. J. (Cedars-Sinai Med. Cent., Los Angeles, Calif.). *N. Engl. J. Med.* 292(12):599-656, 1975.

The effects of treatment with chenodeoxycholic acid (750 mg/day) and/or phenobarbital (180 mg/day) were studied in 22 women and 14 men with asymptomatic radiolucent gallstones and radiologically visualized gallbladders. After 1 yr, chenodeoxycholic acid, phenobarbital and the combination, but not placebo, significantly decreased biliary cholesterol saturation. This effect was significantly greater with chenodeoxycholic acid and the combination than with phenobarbital. Gallstone size decreased more than 50% in nine of 20 patients receiving chenodeoxycholic acid, either alone or combined with phenobarbital, but in no patient receiving only phenobarbital or placebo. Gallstones disappeared completely in patients receiving the combination. Abnormalities in liver-function tests in three of 36 patients, and in five of 16 liver biopsies, occurred with equal frequency in the four treatment groups. Thus, after 1 yr, phenobarbital alone was ineffective in gallstone dissolution. Chenodeoxycholic acid alone or combined with phenobarbital, however, offered a partially effective and safe treatment for asymptomatic radiolucent gallstones.

3572 .. MITRAL VALVE DEFECTS AND BILIARY DISEASE. *(Ger.)* Koelsch, K. A.; Zemlin, C. (Altstadt Reg. Hosp., Magdeburg, Germany). *Z. Gesamte Inn. Med.* 30(2):51-54, 1975.

Of 184 women, aged 21-84 yr (mean 61.3 yr) who died with a mitral valve defect between 1961 and 1971, 80 (43.5%) had biliary disease. These patients consisted of 76 (41.3%) who either had cholelithiasis or had undergone surgery for it; two with acalculous cholecystitis; and two with cholesteatosis. Of these 184 women, 120 had undergone 1-10 pregnancies. The incidence of biliary disease among these women was only 38.3%, while 26 of the 42 nulliparae (61.9%) had biliary disease. Women who died before the age of 50 generally had the most severe mitral valve defects and the highest incidence of biliary disease, suggesting that there is a correlation between the severity of the heart disease and the incidence of cholelithiasis. This was confirmed by comparing the incidence of biliary disease as a function of the type of mitral valve defect. The incidence of cholelithiasis was highest among women who had damage to other heart valves in addition to the mitral valve (51.1%) and among those with mitral insufficiency (50.0%). Cholelithiasis was also found in three of the five women with defects of the tricuspid, mitral, and aortic valves; two of these three patients had cirrhosis, and the liver was undergoing cirrhotic transformation in the third. Of 21 patients with severe liver disease (cirrhotic transformation, cardiac cirrhosis, or other forms of cirrhosis), 13 (61.8%) had biliary disease. No association was found between biliary disease and obesity or diabetes mellitus in this group of patients.

3573 RACIAL INFLUENCE ON THE INCIDENCE OF BILIARY ATRESIA. *(E.)* Shim, W. K. T.; Kasai, M.; Spence, M. A. (Univ. Hawaii Med. Sch., Honolulu). *Prog. Pediatr. Surg.* 6:53-62, 1974.

Estimates of the incidence of biliary atresia for seven major races in Hawaii were obtained. The rate of biliary atresia in Hawaii differs significantly among some of the groups: 0.6/10,000 births for Caucasians, 0.8 for Japanese, 2.0 for Filipinos, and 3.0 for Chinese. There is a 5-fold difference between the Caucasian and Chinese rates. The incidence of biliary atresia among Japanese in Sendai, Japan, is almost exactly the same as it is for the Japanese of Hawaii. The rate for both Japanese and Caucasians is similar, which is contrary to the impression of some pediatric surgeons. When the incidence of biliary atresia is based on hospital admissions, very disparate and non-comparable figures for Hawaii and Sendai are obtained. The reasons for this difference probably reside in the fact that these figures reflect additional variables, such as referable patterns. When incidences are compared on a geographical basis, the rates are dependent upon the racial composition of the local population under consideration. A conglomerate figure for several races is meaningless, so that racial incidence is probably more accurate in com-

paring disease rates. Regression analysis demonstrated that father's age, mother's age, father's race, and birth weight are all significant variables and correlate with the incidence of biliary atresia. However, these factors did not account for more than 1% of the variation and leave 99% of the variation in the etiology of biliary atresia still unexplained.

3574 DIAGNOSTIC EVALUATION OF VARIOUS TECHNIQUES FOR EXAMINING THE DUODENUM IN PATIENTS WITH RECURRENT PAIN AFTER CHOLECYSTECTOMY. *(Rus.)* Buianov, V. M.; Vorobiev, L. P. (N. I. Pirogov 2nd Med. Inst., Moscow, USSR). *Ter. Arkh.* 46(4):48-53, 1974.

Examination of the duodenum and the papilla of Vater was carried out in 106 patients with recurrent pain after cholecystectomy to reveal a variety of organic and functional changes in the duodenum in patients with postoperative syndromes. Directed roentgenological examination showed that 1/3 of the 98 patients had dyskinesia, and 20 patients had duodenitis. In addition to regular x-ray examination, 36 patients had their duodenum x-rayed in conditions of atropine-induced hypotonia. As a result, pancreatitis was found in 12 patients, papillitis in two, and duodenitis in six; no changes were observed in 16 patients. Duodenoscopy revealed that of the 54 patients examined, 28 had duodenitis; 12, acute or stenotic papillitis; seven indirect signs of the inflammation in the head of the pancreas. It is concluded that 2/3 of the examined patients had functional or morphologic changes in the duodenum and the papilla of Vater. Of the available diagnostic techniques, duodenoscopy appears to be the most effctive in combination with duodenometry and duodenography.

3575 STENOSING LESIONS OF THE BILIARY TREE: EVALUATION WITH ENDOSCOPIC RETROGRADE CHOLANGIOGRAPHY (ERC) AND PERCUTANEOUS TRANSHEPATIC CHOLANGIOGRAPHY (PTC). *(E.)* Geisse, G.; Melson, G. L.; Tedesco, F. J.; Kelly, J. J.; Stanley, R. J. (Washington Univ. Sch. Med., St. Louis, Mo.). *Am. J. Roentgenol. Radium Ther. Nucl. Med.* 123(2):378-385, 1975.

Nine patients with localized or diffuse stenosing lesions of the biliary tree and a tenth patient with a by-passing choledochojejunostomy were evaluated using endoscopic retrograde cholangiography (ERC) and/or percutaneous transhepatic cholangiography (PTC). The patients were premedicated with atropine (0.6 mg, i.m.), meperidine (50 mg, i.m.), diazepam (10-20 mg, i.v.), and a pharyngeal spray containing 2% tetracaine; they were examined with the Olympus duodenofiberscope JF Type B. ERC revealed intra- and extrahepatic narrowing and marked luminal irregularity consistent with sclerosing cholangitis in three patients. In two of these patients, the cholangitis was associated with ulcerative colitis. In a fourth case, ERC demonstrated extensive intermittent narrowing of the intrahepatic duct system highly suggestive of secondary sclerosing cholangitis; open wedge liver biopsy showed marked ascending cholangitis with periductal fibrosis. In another case, ERC showed high-grade stenosis confined to the junction of the left and right hepatic ducts; the diagnosis of primary scirrhous carcinoma was confirmed at surgery. Uncomplicated, discrete, postsurgical extrahepatic strictures were demonstrated in three additional cases; in one of these, PTC was needed to supplement the diagnostic evaluation in that ERC did not show the length of stricture or appearance of the biliary tree proximal to the stricture. In the tenth case, PTS demonstrated stricture at the choledochojejunal anastomosis and a peculiar rectangular filling defect within an hepatic duct proximal to the stricture; the interpretation of a retained portion of surgical stint was confirmed at surgery. When supplemented with the appropriate use of PTC, many lesions of the biliary treat which heretofore were not diagnosable preoperatively can be clearly defined with ERC. These techniques are of value in diagnosis, determination of prognosis, and the provision of visual data on which to plan a surgical approach.

3576 CHOLELITHIASIS IN CHILDREN. *(Ger.)* Jenny, P.; Ferel, G.; Herzog, B. (Child. Hosp., Basel, Switzerland). *Helv. Chir. Acta* 41(5/6):757-759, 1974.

Five cases of cholelithiasis in children in the patient material of the Basel Children's Hospital during the 1951-1973 period are reported. The incidence was in agreement with literature data indicating one case out of 7,000 to 12,000 admissions. The patients, four females and one male, were aged 6.5-14 yr at the time of the operation. Spherocytosis with hemolysis was diagnosed in two cases as an underlying disease, and portal hypertension with esophageal varices was found in two other cases. The etiology was obscure in one case. No increased frequency of cholelithiasis was found in any of the respective families. Epigastric pains were found to be the principal symptom of the disease, while colic was infrequent. Cholecystectomy was successful in four cases, and a pea-sized solitary stone was removed by cholecystotomy in another case.

3577 INTERNAL DIAMETER OF THE COMMON BILE DUCT AND ITS SIGNIFICANCE IN EVALUATING THE BILIARY TRACT DURING SURGERY. *(Ger.)* Persenico, S. G.; Schamaun, M. (Rhaetian Canton. Reg. Hosp., Chur, Switzerland). *Helv. Chir. Acta* 41(5/6):615-618, 1974.

The internal diameter of the common bile duct was determined in 252 adult patients with diseases of the

biliary duct by intraoperative cholangiography, using a new radiomanometric method, to establish relationships between the internal diameter of the common bile duct and the incidence of pathological conditions. The findings indicate that it is impossible to infer any pathological conditions from the internal diameter of the common bile duct in a range of 5 to 11 mm. However, the probability of pathological changes increases with the internal diameter. While the probability of pathological changes is very slim at diameters below 8 mm, it increases to 23.5% at 9 mm, to 40% at 10 mm, and to 57% at 11 mm diameter. Internal diameters greater than 11 mm were found to be always indicative of pathological changes of the common bile duct. The internal diameter of the common bile duct was found to be independent of sex and the duration of the symptoms, while a slight increase in diameter with advancing age was observed.

3578 PRIMARY SCLEROSING CHOLANGITIS. *(Ger.)* Arma, S.; Fleischer, M.; Fumagalli, I. (B. V. Hosp., Mendrisio, Switzerland). *Helv. Chir. Acta* 41(5/6):699-703, 1974.

Primary sclerosing cholangitis in a 73-yr-old male patient is described. Cachexia, pruritus, mild intermittent obstructive jaundice, and bilirubin levels between 4 and 6 mg% were the first findings. Slight hepatomegalia, considerable thickening of the walls of the gallbladder and of the extrahepatic bile duct, enlarged lymph nodes in the hepatoduodenal ligament, and pronounced collagen proliferation with lymphocyte and plasmocyte infiltration of the gallbladder wall were found during choledochoduodenostomy. Total regression was acheived in a relatively short time following surgery and corticosteroid (betamethasone) therapy.

3579 PRIMARY AND SECONDARY SCLEROSING CHOLANGITIS. *(Ger.)* Hahnloser, P.; Forrer, P.; Knoblauch, M. (Canton. Hosp., Zurich, Switzerland). *Helv. Chir. Acta* 41(5/6):691-698, 1974.

A case of primary sclerosing cholangitis in a 41-yr-old male patient is reported, and etiological and symptomological problems of primary and secondary sclerosing cholangitis are discussed. Recurrent lymphadenitis and bilateral sclerosis of the hili, axillary lymphadenitis, extrahepatic and intrahepatic sclerosis of the biliary ducts, jaundice, septic temperature, and obstruction of the right hepatic duct justified the diagnosis of primary sclerosing cholangitis against the background of multifocal sclerosis. Unlike secondary sclerosing cholangitis, primary sclerosing cholangitis continues to be of unknown etiology. It is impossible to distinguish between the pure form and that combined with other fibrotic diseases of equally unknown etiology, such as multifocal fibrosis, fibrosing mediastinitis, ulcerative colitis, Crohn's disease, or Riedel's goiter. Intermittent obstructive jaundice with or without septic temperatures is a common feature of primary and secondary sclerosing cholangitis. While secondary forms can be corrected by removal of the biliary duct obstruction, primary forms usually progress into secondary biliary cirrhosis with suppurative hepatitis and coma despite adequate long-term drainage by biliodigestive distulization and long-term steroid and antibiotic therapy.

3580 FLATULENT DYSPEPSIA IN PATIENTS WITH GALLSTONES UNDERGOING CHOLECYSTECTOMY. *(E.)* Kingston, R. D.; Windsor, C. W. O. (Worcester R. Infirm., England). *Br. J. Surg.* 62(3):231-233, 1975.

The incidence of flatulent dyspepsia and its relation to gallbladder function was studied in 100 consecutive patients (75 women, 25 men, aged 17-80 yr) with gallstones undergoing cholecystectomy. The follow-up was between 3 months and 3 yr. A patient was considered to have flatulent dyspepsia if 3 or more of the following symptoms were present consistently to a moderate or severe degree: repeated belching; feeling full after a normal-sized meal; inability to finish a normal sized meal; abdomen blown out so that clothes need to be loosened; burning discomfort in the epigastrium; burning discomfort in the chest; and vomiting or nausea. A combination of the last 3 symptoms only was not classified as flatulent dyspepsia. Thirty-three percent of patients suffered significant flatulent dyspepsia of whom 80% were cured or improved by operation. Pre- and postoperative gastric emptying times were measured in 15 patients: 5 flatulent dyspeptics who were cured by operation, 5 who were not cured, and 5 patients without symptoms of flatulent dyspepsia. There was no difference in gastric emptying times between patients with flatulent dyspepsia who were cured by operation and those who remained symptomatic. The symptoms of flatulent dyspepsia were correlated with the bacteriological findings of the bile taken from the gallbladder at operation. In the nondyspeptic group equal numbers of patients (13) had infected and noninfected bile. In the dyspeptic patients 8 had infected bile and 5 had sterile bile. Seven of 8 patients cured of the dyspepsia by operation had infected bile, while the bile was sterile in those whose symptoms remained. This suggests that infection within the gallbladder may be a factor in the causation of flatulent dyspepsia. Half of the nondyspeptic patients, however, had infected bile, indicating that it may be a matter of degree and a certain type or level of infection needing to be present before becoming significant in producing flatulent dyspepsia. The concept of a functioning gallbladder emptying infected bile into the duodenum producing an ileus with reflux of bile into the stomach appears to be a very possible cause of flatulent dyspepsia.

3581 PERIBILIARY FAT: A NEW ROENTGENOGRAPHIC FINDING. *(E.)* Shaub, M. S.; Birnbaum,

W. W.; Meyers, H. I. (Univ. South. California Med. Cent., Los Angeles). *Am. J. Roentgenol. Radium Ther. Nucl. Med.* 123(2):330-337, 1975.

The roentgenographic appearance of peribiliary fat which is seen in the right upper quadrant in the area of the liver, adjacent to the bile ducts is described and illustrated. Fat adjacent to the bile ducts appeared roentgenographically either as branching or linear lucencies on plain films of the right upper quadrant or as lucencies adjacent to the bile ducts on i.v. cholangiograms or oral cholecystograms. This lucency was best seen adjacent to the common hepatic and the common bile duct. In some of the early cases seen by the authors, the fat caused lucencies which simulated gas to such a degree that it was considered as a primary diagnosis. The patients, however, had no discernible reason to have gas within the biliary tree. The biliary system was examined at numerous autopsies and it became apparent that fat normally occurs around the bile ducts up to their entrance into the liver. The quantity of fat was roughly proportional to the amount of fat present in the remainder of the subject's body. Thus, the findings of upper right quadrant lucencies due to peribiliary fat are seen roentgenographically most frequently in obese individuals. It was found that these lucencies could help in identifying, locating, and measuring the diameter of the common bile duct when it is only faintly visualized on an i.v. cholangiogram or when its anatomical course is atypical. A review of the literature showed no previous description of the roentgenographic appearance of peribiliary fat. It is suggested that the significance of these findings is that branching or linear right upper quadrant lucencies are not necessarily gas within the biliary or portal system but may be due to prominent peribiliary fat.

3582 LIVER AND PANCREAS SCANNING IN EXTRAHEPATIC OBSTRUCTIVE JAUNDICE (WITH SPECIAL REFERENCE TO TUMOURS OF THE BILE AND HEPATIC DUCTS). *(E.)* Agnew, J. E.; James, O.; Bouchier, I. A. D. (R. Free Hosp., London, England). *Br. J. Radiol.* 48(567):190-199, 1975.

^{198}Au-gold colloid liver scans and ^{75}Se-selenomethionine pancreas scans in 72 patients with extrahepatic obstructive jaundice were assessed by blind marking to determine: 1) if there is a recognizable liver scan appearance in extrahepatic jaundice, whatever the cause; and 2) if combined liver and pancreas scanning can help to distinguish between carcinoma of the bile and hepatic ducts, pancreatic carcinoma, and nonmalignant extrahepatic biliary obstruction. Of the 72 patients, 25 had carcinoma of the bile or hepatic ducts, 30 had carcinoma of the pancreas with obstructive jaundice, and 17 had nonmalignant obstructive jaundice with normal pancreas. Their scans were compared with liver and pancreas scans from 20 control patients and liver scans from 33 patients with diffuse liver disease. Of the liver scans in extrahepatic obstructive jaundice, 56% showed a filling defect in the hilar region of the liver. This was most frequently seen in the most deeply jaundiced patients, and was reported in 80% of patients with a serum bilirubin greater than 15 mg/100 ml. Combined pancreas and liver scans could not always distinguish between different forms of extrahepatic obstructive jaundice. A normal pancreas scan, however, can virtually exclude a pancreatic carcinoma as the cause of obstructive jaundice. A pancreas scan showing severely reduced uptake favors a diagnosis of carcinoma of the pancreas or of the lower end of the common bile duct. A liver scan showing defective left lobe uptake coupled with a pancreas scan showing normal or only moderately reduced uptake suggests the diagnosis of a carcinoma of the hepatic ducts.

3583 ACUTE REVERSIBLE RENAL FAILURE IN PATIENTS WITH ACUTE CHOLECYSTITIS AND CHOLANGITIS. *(E.)* Burden, R. P.; Ash, D. V.; Boyd, W. N.; Gray, J. G.; Aber, G. M. (North Staffordshire Med. Inst., Stoke-on-Trent, England). *Q. J. Med.* 44(173):65-77, 1975.

Renal function was assessed in 14 patients with acute cholecystitis and 2 patients with acute cholangitis in order to establish the incidence and nature of the renal involvement in these diseases. The patients (9 women and 7 men) ranged in age from 30-77 yr and none gave a history of renal disease or urinary tract symptoms. All patients were treated with ampicillin (1 g/day, p.o. or i.v.) and parenteral fluids when indicated. Transient elevations in serum bilirubin, alkaline phosphatase, and SGOT were seen in every case, but only 2 patients had elevated serum amylase concentrations. Liver function tests and serum amylases returned to normal limits within 3-15 days. Six patients had no evidence of renal impairment, 4 had modest elevations in their plasma urea and creatinine concentrations, and 6 had acute reversible renal failure; 3 patients in the latter category required peritoneal dialysis. There was no correlation between the initial plasma creatinine and bilirubin concentrations. All patients had transient polymorphonuclear leucocytosis, 4 showed a transient thrombocytosis, and 5 had thrombocytopenia and RBC fragmentation. Plasma fibrogen and serum fibrin degradation products were elevated in all 8 patients in whom they were measured; these concentrations returned to normal limits on recovery. Most blood cultures were negative for bacteria and all mid-stream urine specimens were sterile. Of 5 bile specimens examined, *E. coli* was isolated in 4 and *Klebsiella* was isolated in the 5th. Renal angiography in 2 patients showed arterial narrowing and occlusion with cortical artifacts. There was a high incidence of facial herpes simplex in the patients who developed renal failure. Conservative management of acute renal failure accompanying acute cholecystitis and cholangitis is advisable. In the patients studied, renal failure probably occurred as a result of intravascular coagulation triggered by hypovolemia, bacteremia, or concomitant pancreatitis.

3584 BILE-SALT GLUCURONIDES IN URINE: SHORT COMMUNICATION. *(E.)* Back, P.; Spaczynski, K.; Gerok, W. (Med. Clin., Univ. Freiburg, Germany). *Hoppe Seylers Z. Physiol. Chem.* 355(6):749-752, 1974.

Synthetic sulphate esters of bile acids, after undergoing solvolytic cleavage, were analyzed to determine whether glucuronide binding occurred in the bile acids prior to renal excretion. Bile acids were extracted from 100 ml of urine obtained from a jaundiced patient and analyzed using various procedures involving treatment with β-glucuronidase. The analytical data give evidence that bile acids are excreted into human urine not only as taurine- and/or glycine-conjugated compounds and as sulphate esters of conjugated derivatives, but also as glucuronides of free acids and of conjugated bile acids.

3585 SURGICAL PATHOLOGY OF THE GALLBLADDER AND BILIARY TRACT: RETROSPECTIVE STUDY OF 4363 CASES. *(Fr.)* Rigo, M.; Mosimann, R.; Ryncki, P.; Saegesser, F. (Dept. Surg., Univ. Lausanne, Switzerland). *Helv. Chir. Acta* 41(5/6):533-536, 1974.

3586 CHOLEDOCHOTOMY IN ELDERLY PATIENTS. *(Rus.)* Tetdoev, A. M.; Negrei, V. A. (S. M. Kirov Mil. Med. Acad., Leningrad, USSR). *Vestn. Khir.* 113 (9):13-18, 1974.

3587 INDICATIONS FOR SPHINCTEROTOMY. *(Fr.)* Roux, M. (no affil.). *Helv. Chir. Acta* 41(5/6):779-788, 1974.

3588 RESECTION OF THE CYST AND END-TO-SIDE ANASTOSOMIS OF THE HEPATIC DUCTS TO THE DUODENUM IN CONGENITAL CYSTIC DILATATION OF THE COMMON BILE DUCT. *(Fr.)* Grosdidier, J.; Boissel, P.; Richaume, B.; Baudesson, D. (no affil.). *J. Chir. (Paris)* 107(2):117-124, 1974.

3589 SUTURELESS ANASTOMOSIS: EXPERIENCE WITH A NEW ANASTOMOTIC TECHNIQUE AND LONG-TERM DRAINAGE IN HEPATOCHOLANGIOJEJUNOSTOMY. *(Ger.)* Zockler, C. E.; Akdemir, B.; Dethlefsen, H.; Strosche, H. (Zwekverband Hosp., Bad Oeynhausen, Germany). *Langenbecks Arch. Chir.* 336(4):281-302, 1974.

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See also, 2506, 2599, 2609, 2700, 2767, 2871, 2872, 2873, 2880, 2907, 2908, 2909, 2910, 2912, 2913, 2915, 2916, 2917, 2918, 2922, 2926, 2935, 2942, 2949, 2950, 2952, 2953, 2962, 3129, 3130, 3163, 3170, 3319, 3320, 3329, 3335, 3340, 3345, 3359, 3365, 3387, 3388, 3406, 3408, 3418, 3523, 3538, 3704, 3753, 3764, 3784.

GENERAL

3650 PEUTZ-JEGHERS SYNDROME: ITS NATURAL COURSE AND MANAGEMENT. *(E.)* Utsunomiya, J.; Gocho, H.; Miyanaga, T.; Hamaguchi, E.; Kashimure, A.; Aoki, N.; Komatsu, I. (Sch. Med., Tokyo Med. Dent. Univ., Japan). *Johns Hopkins Med. J.* 136(2):71-82, 1975.

A total of 102 patients with Peutz-Jeghers syndrome were part of a follow-up study. The average age at diagnosis differed little between the sexes, 23 yr for males and 26 yr for females. However, the age distribution curve showed a clustering of males at younger ages. The male:female ratio was 1:1.13. Presenting symptoms included obstruction in 42.8% of the cases, abdominal pain in 23.4%, bloody stool in 13.5%, and anal extrusion of the polyp in 7.2%. The remaining 23.4% were diagnosed primarily because of melanin pigmentation. The most serious complication, intussusception, occurred in 105 cases, mostly in the small intestine (95.2% of the cases). Polyps were detected in 195 of the 222 recorded cases (those for which clinical data was available). The polyps occurred throughout the digestive tract, with the exception of the esophagus. Malignant changes of the polyps were histologically confirmed in 28 cases; including 15 examples of early cancer and 11 of advanced cancer. Although a diagnosis of advanced cancer in the Peutz-Jeghers syndrome does not necessarily indicate that it developed in a polyp, it is noted that many instances of advanced cancer in various parts of the gastrointestinal tract occurred in the present series. Melanin spots were

located in the lips or perioral region (94.1%), the buccal mucosa (65.8%), and distal portion of the limbs (73.9% in the upper and 62.2% in the lower extremities) with additional spots in other locations in 21.2% of the examined cases. Of the 102 follow-up cases, 36 were known to have died. Of those who died before age 30, 42.9% were due to polyposis; death occurring after age 30 was attributed to neoplastic disease in about 60% of the cases. Affected parents were found in 57 cases. In one case an affected sibling was found, but diagnosis was not established in either parent. Thus the 58 familial cases amounted to 45.7% of the 127 affected individuals whose family histories were ascertained. Conservative treatment is recommended. If operative measures are necessary, injury to intestinal mucosa should be as limited as possible. If intussusception occurs in the small intestine, polypectomy is mandatory. Polyps in the stomach do not usually produce acute complications. Polyps of the large intestine, though rarely causing intussusception, may cause continuous bleeding in which case fiberscopic polypectomy is useful. If the patient is over 30 yr old, and the polyps are numerous, subtotal colectomy with cecoproctostomy may be carried out due to the high risk for cancer. The results of this study allow the conclusion that persons with the Peutz-Jeghers syndrome are at increased risk for cancer development, particularly cancer of the colon.

3651 ABDOMINAL ACTINOMYCOSIS. *(Fr.)* Mousseau, P. A.; Mousseau-Brodu, M. C. (Hotel Dieu, Nantes, France). *J. Chir. (Paris)* 106(6):565-588, 1973.

Case reports are presented for 4 patients with abdominal actinomycosis, and the 124 documented cases which have appeared in the literature since 1850 are reviewed. A 67-yr-old farm woman and a 60-yr-old cook underwent surgery for suspected cancer of the colon. However, examination of material obtained from a right hemicolectomy, performed on the first patient, showed an amyloid mass, 4 cm in diameter, in the cecum and ascending colon. The peritoneum was hypertrophied and fibrous and contained scattered foci of inflammation surrounded by sulfur granules. The second patient underwent extensive resection of the transverse colon and a loop of small intestine adhering to the tumor. On pathological examination, the tumor proved to be a thickened mucosal infiltration 3 cm long. The mesocolon and mesentery contained scattered necrotic abscesses surrounded by sulfur granules; these abscesses had penetrated the walls of the colon and small intestine. Another patient with actinomycosis of the small intestine had suppurating peritonitis due to perforation of a tumor the size of a potato; perforation was due to an ulcerative process. In serosal exudate there was a microabscess surrounded by a dark mass suggestive of *Actinomyces*. All 3 of these patients recovered uneventfully after removal of the lesion and antibiotic therapy. A 40-yr-old farm worker with a mass in the right iliac fossa proved to have an "anthracoid" abscess between the liver and colon at laparotomy. This was shown to result from an *Actinomyces* infection. The patients recovered after drainage of the abscess and antibiotic therapy.

3652 ACUTE NECROTIZING ENTEROCOLITIS IN INFANCY: A REVIEW OF 64 CASES. *(E.)* Santulli, T. V.; Schullinger, J. N.; Heird, W. C.; Gongaware, R. D.; Wigger, J.; Barlow, B.; Blanc, W. A.; Berdon, W. E. (Coll. Physicians Surg., Columbia Univ., New York, N.Y.). *Pediatrics* 55(3):376-387, 1975.

Clinical experience with 64 patients (35 girls and 29 boys) seen over a 20-yr period with acute necrotizing enterocolitis in infancy was reviewed. Of the 64 patients, 47 were born prematurely (73%). Diagnosis was based on tissue examination in 57 and on clinical syndrome, including pneumatosis, in 7. It is suggested that there are different gradations of this disease and that a much larger number of infants are seen and treated before developing the complete syndrome. Three factors are important in the development of the disease: injury to the intestinal mucosa; the presence of intestinal bacteria; and feedings (as a substrate for the bacteria). The importance of stress in the pathogenesis of the disease is confirmed by the high incidence of perinatal complications, particularly hypoxia. It was felt that indirect injury to the mucosa on the basis of selective mesenteric ischemia in response to stress was more important than direct injury to the mucosa from hyperosmolar feedings. Six of 37 patients treated medically survived. Their management included nasogastric decompression, i.v. fluid therapy, attention to acid-base and electrolyte balance, parenteral broad-spectrum antibiotics, frequent physical examination, and roentgenographic studies every 4 hr to detect pneumoperitoneum. Operations were performed on 27 patients; 8 survived. Indications for operation were pneumoperitoneum, peritonitis, and intestinal obstruction. Overall survival rate was 14 of 64 patients (22%). Survival was 16% without and 30% with operation. The preferred procedure is resection of all involved portions of bowel with a proximal enterostomy (chimney) type of side-to-end anastomosis, or resection with double enterostomy when the former is not feasible. The current plan of management requires immediate cessation of oral or gavage feedings, institution of nasogastric tube suction and administration of appropriate i.v. fluids. Parenteral antibiotics are given, usually ampicillin (150 mg/kg/24 hr). Topical antibiotics are administered by gavage at one or two times the parenteral dose of kanamycin or gentamycin/day in 6 divided doses. Low molecular weight dextran 40 is given i.v. in 10% solution, 10 mg/kg every 6 hr for 48 hr. Supine and left side down decubitus x-ray films are taken every 4 to 6 hr to detect unrecognized pneumoperitoneum or peritoneal fluid, and the infant is examined frequently for localized peritonitis. Any of these changes indicates surgery. Of the last 10 patients so treated, only one was operated on and she survived. Of the nine not operated on, four survived.

3653 FACTORS AFFECTING BILE ACID METABOLISM IN CHOLERRHEIC ENTEROPATHY. *(E.)* Mitchell, W. D.; Findlay, J. M.; Macrae, R.; Eastwood, M. A.; Anderson, R. (Univ. Dep. Med., Edinburgh, Scotland). *Digestion* 11(1/2):135-146, 1974.

Fecal bile acid excretion and mouth to anus transit time were measured in 10 normal subjects and 9 patients (4 females and 5 males, aged 32-78 yr) with cholerrheic enteropathy. Bacteriological examination of the feces was carried out. All patients had ileal resections of varying lengths and had diarrhea. There was a significant increase in daily fecal weight and total bile acid excretion in feces of patients compared to normal subjects. There was also a marked difference in the pattern of bile acids excreted. Diarrheal patients excreted mainly 3,7-disubstituted (chenodeoxycholic acid) and 3,7,12-trisubstituted (cholic acid) bile acids whereas normal subjects excreted only 3-monosubstituted (lithocholic acid) and 3,12-disubstituted (deoxycholic acid) bile acids. The transit time in patients with ileal resection (mean 36.1 hr) was shorter than controls (mean 54.5 hr.). The concentration of bile acids in the stool from patients with ileal resection diarrhea was 3-4 times more than that for normal individuals, 16.4 *versus* 4.9 mM. There was no significant difference in the type and number of microorganisms occurring in the feces of the two groups. The pH of the fecal homogenate remained constant at pH 7 even after anaerobic incubation for 48 hr, thus explaining why no significant change in bacterial counts were observed after incubation with high concentrations of bile acids. The effect of altering the concentration of sodium taurocholate, sodium glycocholate and sodium taurochenodeoxycholate on the deconjugation and 7α-dehydroxylation of these bile acids by a fecal homogenate from a normal subject was also studied. There was no evidence of inhibition of deconjugation at concentrations as high as 15 mM. However, there was progressive inhibition of 7α-dehydroxylation at 24 and 48 hr with increasing concentration of bile acids, and at 10 mM and above, there was complete inhibition. Deconjugation of bile acid conjugates was normally complete between 6 and 12 hr. It was only after 24 hr that appreciable 7α-dehydroxylation occurred. These results support earlier findings that the major initial reaction in the catabolism of bile salts by intestinal bacteria is hydrolysis of the amide link. It is concluded that the presence of primary bile acids in the stool of patients with ileal resection can be explained by the inhibitory effect of bile acids at concentrations of more than 15 mM. At bile concentrations of less than 15 mM, transit time becomes relevant to 7α-dehydroxylation by fecal microorganisms.

3654 SERUM α-FETOPROTEIN IN PATIENTS WITH NEOPLASMS OF THE GASTROINTESTINAL TRACT. *(E.)* McIntire, K. R.; Waldmann, T. A.; Moertel, C. G.; Go, V. L. W. (Natl. Cancer Inst., Bethesda, Md.). *Cancer Res.* 35(4):991-996, 1975.

Serum α-fetoprotein (AFP) levels were measured by a double-antibody radioimmunoassay technique in 580 patients with a variety of malignant and nonmalignant gastrointestinal diseases to determine the incidence of levels elevated above 40 ng/ml. Serum samples from 180 normal adults and 20 normal children (1-10 yr of age) were measured and the AFP levels were all less than 40 ng/ml. Elevated AFP levels were demonstrated in 24% of 45 patients with pancreatic carcinoma, 25% of eight patients with biliary tract carcinoma, 15% of 95 patients with gastric carcinoma, 3% of 191 patients with colorectal carcinoma, and 70% of 73 patients with primary liver carcinoma.

3655 SUBPOPULATIONS OF THYMUS DEPENDENT AND THYMUS INDEPENDENT LYMPHOCYTES IN HUMAN GUT ASSOCIATED LYMPHOID TISSUES. *(E.)* Mavligit, G. M.; Jubert, A.; Gutterman, J. U.; Reed, R. C.; Hersh, E. M. (M. D. Anderson Hosp. Tumor Inst., Houston, Texas). *Surg. Gynecol. Obstet.* 140(3): 397-400, 1975.

The proportions of thymus independent and thymus dependent cells in the human appendix and terminal portion of the ileum were studied using immunofluorescence and by rosette formation techniques. Lymphoid tissues from the appendix, terminal ileum, and mesenteric lymph nodes were obtained from two patients undergoing subtotal colectomy (one had Gardner's syndrome and the other had multiple familial polyposis). Spontaneous rosette formation with sheep erythrocytes (E-rosettes) was used to determine thymus dependent lymphocytes. Rosette formation with sheep erythrocytes coated with anti-sheep red blood cells antibody and complement (EAC-rosettes) was used to determine thymus independent lymphocytes. Direct immunofluorescence was also used to determine thymus independent lymphocytes. In the first patient, the appendix and terminal ileum both contained substantial numbers of thymus dependent and independent lymphocytes in almost equal proportions. The rosette formation technique showed a higher percentage of thymus independent cells than did the immunofluorescence technique. In the second patient, only the appendix was available for study but it showed both types of lymphocytes. In lymphocytes from all tissues studied, the predominant surface-bound immunoglobulin was IgM. Thus it was shown that both thymus independent and thymus dependent lymphocytes were present in human gut associated lymphoid tissues.
Of 14 patients with esophageal or small-bowel carcinoma, none had elevated serum AFP levels. Only 1% of 154 patients with nonmalignant, nonhepatic gastrointestinal disease had elevations of AFP. There was a significant elevation of AFP in patients with gastrointestinal neoplasia and the incidence of elevation was dependent upon the site of origin. Patients with carcinoma of the pancreas, biliary tract, and stomach had a greater incidence of elevations than those with carcinoma of the colon, esophagus, or small bowel. The authors suggest that serum α-fetoprotein may or may not be a useful marker for early diagnosis of gastrointestinal cancer, but for patients with advanced cancer, it could act as a marker to indicate the extent of the disease.

3656 SECRETORY AND SERUM IgA IN CHILDREN WITH PROTEIN-CALORIE MALNUTRITION. *(E.)* Sirisinha, S.; Suskind, R.; Edelman, R.; Asvapaka, C.;

Olson, R. E. (Dep. Microbiol., Fac. Sci., Mahidol Univ., Bangkok, Thailand). *Pediatrics* 55(2):166-170, 1975.

Secretory immunoglobulin A (IgA) levels of children with protein-calorie malnutrition were measured on admission and during dietary treatment. Twenty-four children aged 1-5 yr had either marasmus (7), marasmus-kwashiorkor (9), or kwashiorkor (8). A majority were judged to have bacterial infections by clinical impression, leukocyte counts, chest x-ray, and blood and stool cultures. Normal well nourished children from the same area served as controls. IgG, and secretory IgA concentrations in nasal washings were determined by electroimmunodiffusion. Secretory IgA concentrations were significantly lower (16.1%) than control values (24.3%) and total serum protein, IgG and albumin were slightly reduced. These values remained substantially the same for days 1-70, but values from days 71-84 were not significantly different from control values. There was no correlation between the values and the 3 different clinical states of the children. Serum IgA was significantly higher in the malnourished children at admission than after dietary treatment, but no secretory component was present and no correlation existed between IgA values for serum and nasal washings. It is concluded that protein-calorie malnutrition results in a small but significant deficiency in secretory IgA, but this probably does not account for susceptibility of these children to infection.

3657 HISTOCOMPATIBILITY ANTIGENS AND SOLID MALIGNANT NEOPLASMS. *(E.)* Tarpley, J. L.; Chretien, P. B.; Rogentine, Jr., G. N.; Twomey, P. L.; Dellon, A. L. (Natl. Cancer Inst., Bethesda, Md.). *Arch. Surg.* 110(3):269-271, 1975.

The relation between histocompatibility antigen phenotypes and solid malignant neoplasms was studied in 633 cancer patients and compared with 489 normal controls by human lymphocyte antigen (HL-A) typing. HL-A typing for 21 specificities was performed by standard microcytotoxicity method. HL-A frequencies were compared using chi-square analysis employing 2 x 2 tables. HL-A8 was elevated in patients with squamous cancer, melanoma, and adenocarcinoma, with the highest incidence in those with salivary gland adenocarcinoma (67% as compared to 17% in controls). A threefold increase in HL-A5 occurred in patients with connective tissue sarcomas (28% as compared to 9% in controls). The patients were studied at varying intervals from time of diagnosis and treatment. Antigen frequencies did not vary when analyzed by time of diagnosis or interval after treatment, thus there was no correlation with survival. The results suggested that certain malignant neoplasms are associated with increased frequency of individual HL-A antigens, and this may give clues to cause and genesis for these tumors.

3658 INFLAMMATION OF THE INTESTINAL MUCOSA AND IMMUNOGLOBULIN PRODUCTION. *(Fr.)* Fodor, O.; Dumitrascu, D.; Radu, D.; Dejica, D.; Grigorescu, M. (3rd Med. Clin., Cluj, Rumania). *Ann. Gastroenterol. Hepatol. (Paris)* 10(5):377-387, 1974.

Immunoglobulins were determined quantitatively by radial immunodiffusion in the jejunal contents of 30 patients with chronic nonspecific enteropathies and the density of plasma cells containing the various types of immunoglobulins was studied by using the direct immunofluorescence technique on frozen or paraffin-embedded sections from the rectal mucosa of 18 patients with ulcerative colitis. In chronic nonspecific enteropathies, intraluminal IgA concentrations were significantly decreased in patients whose jejunal contents contained bacteria; this implies that there is a local immune deficiency. Significant decreases in intraluminal IgA concentrations were also detected in patients with inflammatory changes in the jejunal mucosa. Although IgG and IgM levels exhibited considerable individual variation with no apparent pattern, the sum of IgG and IgM concentrations was correlated with IgD and IgA concentrations, indicating that common immune effects were exerted on local immunoglobulins (IgA) and on the serum types (IgG and IgM). The mean serum IgA concentrations were increased in this group of patients, and the highest concentrations of IgA were found in patients with bacteria in the jejunal contents. In patients with ulcerative colitis, all of whom were in remission, the density of plasma cells containing IgA was decreased in the villous mucosa. No IgA was found at the apical pole of glandular cells in severe forms of ulcerative colitis and acute bacillary dysentery. A large number of cells containing IgE were detected in many cases. The number of cells containing IgG, IgM, and IgD was within normal limits.

3659 EFFECT OF LACTOSE-INDUCED DIARRHOEA ON ABSORPTION OF NITROGEN AND FAT. *(E.)* Bowie, M. D. (Dept. Pediatr., Univ. Cape Town, Rondebosch, South Africa). *Arch. Dis. Child.* 50(5):363-366, 1975.

The absorption of fat and the absorption and retention of nitrogen were studied in 20 children with kwashiorkor. Thirteen of the children showed marked variation of stool weight, stool lactic acid content, and stool sugar on being changed from milk to disaccharide-free diet and back again. These children had severe diarrhea while on milk. Lactose malabsorption in this group (nonabsorbers) was confirmed by abnormal lactose tolerance tests and low or absent small intestine mucosal lactase enzyme assay. Seven children (absorbers) showed little variation in stool weight and lactic acid content, and satisfactory lactose absorption. Fat absorption was not affected by lactose-induced diarrhea, but nitrogen absorption was impaired. In the nonabsorbers, nitrogen absorption dropped significantly upon reintroduction of milk feeds and reccurrence of diarrhea. Mean stool nitrogen during two periods of lactose-induced diarrhea was 1.14 g and 1.38 g/day. Nitrogen retention in these children was unaffected, and it is concluded that milk and milk products should continue to be used in programs to eliminate malnutrition.

3660 CLINICAL AND IMMUNOLOGICAL ASPECTS OF PROTIEN-LOSING GASTROENTEROPATHY. *(Ger.)* Asakura, H.; Morishita, T.; Morita, A.; Hibi, T.; Ono, A.; Tsuchiya, M. (Sch. Med., Keio Univ., Tokyo, Japan). *Leber Magen Darm* 4(3):109-116, 1974.

Of 24 patients sith protein-losing enteropathy, confirmed by the Gordon test using ^{131}I-polyvinylpyrrolidone, six had intestinal lymphangiectasia; five multiple nonspecific ulcers of the small intestine; three each, Menetrier's disease and ulcerative colitis; two, constrictive pericarditis; and one each, stomach cancer, lymphoid hyperplasia of the small intestine, polyposis of the colon, neuroblastoma with retroperitoneal metastases, and transitory intestinal protein loss. Total serum protein concentrations ranged from 3.0 to 6.6 g/100 ml and serum albumin values, from 1.6 to 4.3 g/100 ml. A significant negative correlation between serum albumin concentrations and the rate of albumin degradation was found in this group of patients, while significant positive correlations were obtained in 17 patients with chronic liver disease and five with intestinal malabsorption. IgG concentrations were decreased in 16 and IgA concentrations, in 14 of these 24 patients with protein-losing enteropathies; one patient with multiple nonspecific ulcers of the ileum had an IgA level increased to 420 mg/100 ml. About half of the patients had decreased IgM concentrations. A correlation between immunoglobulin levels and immunoglobulin-secreting cell populations in the jejunal mucosa was found in only two of the seven patients investigated. In patients with intestinal lymphangiectasia, there was a decrease in the number of cells secreting all three types of immunoglobulins; the IgG and IgA populations were normal and the number of IgG-secreting cells was slightly increased in one patient with Menetrier's disease. After a patient with nonspecific ulcers of the small intestine and massive protein losses underwent ileal resection, the number of cells secreting IgA decreased significantly while serum albumin and IgG concentrations normalized. The late type of skin reaction occurred in only three of nine patients with the Mantoux test and in only one of eight with the dinitrochlorobenzene test. Lymphocyte cultures were transformed by phytohemagglutinin in three patients with intestinal lymphangiectasia, Menetrier's disease, and ulcers of the small intestine, resp., and T-cell populations proved to be normal in all five patients investigated.

3661 CELL RENEWAL OF GASTRIC MUCOSA IN ZOLLINGER-ELLISON SYNDROME. *(E.)* Castrup, H. J.; Fuchs, K.; Peiper, H. J. (Dep. Gen. Surg., Univ. Gottingen, Germany). *Acta Hepatogastroenterol. (Stuttg.)* 22(1):40-43, 1975.

The growth of the gastric mucosal cells was studied in 3 patients with Zollinger-Ellison syndrome by an *in vitro* autoradiographic method. Biopsies of 11 volunteers without pathological changes of the stomach served as controls. For the *in vitro* autoradiographic investigations the double-labeling technique with ^{3}H-thymidine was used. Quantitation of the different labeled cells and determination of the ^{3}H-index in the proliferation zone of the deeper portion of the gastric pits permitted the calculation of the DNA synthesis phase and the mean generation time. Histological examinations were also done to determine mucosal thickness and mean number of parietal cells/fundic gland. In the 3 patients with Zollinger-Ellison syndrome, the fundic gastric mucosa was thickened with a marked increase of the specific glandular cells. The autoradiographic examination showed a significant increase in proliferation of the stomach epithelial cells; the mean generation time was decreased from 72 hr (controls) to 45 hr (patients). The labeling index was increased from 10% (controls) to 15% (patients). The DNA synthesis, the G_2 phase, and the mitotic time were not changed. The results suggest that in Zollinger-Ellison syndrome, gastrin seems to have a trophic effect not only on the parietal and chief cells, but also on the cells of the surface epithelium of the stomach.

3662 RADIATION ENTERITIS IN CHILDREN: A RETROSPECTIVE REVIEW, CLINICOPATHOLOGIC CORRELATION, AND DIETARY MANAGEMENT. *(E.)* Donaldson, S. S.; Jundt, S.; Ricour, C.; Sarrazin, D.; Lemerle, J.; Schweisguth, O. (Pediatr. Radiother. Serv., Inst. Gustave-Roussy, Villejuif, France). *Cancer* 35(4): 1167-1178, 1975.

Clinicopathologic observations and the method of management in 44 children with radiation enteritis were reviewed. All had received whole abdominal irradiation: 42 were treated by cobalt 60 teletherapy and 2 by 250-kV x-rays. Of the 44 children, 25 were given chemotherapy concomitantly with radiotherapy or within 1 month prior to the irradiation. Severe delayed radiation injury with small bowel obstruction occurred within 2 months after irradiation in 5 of 14 long-term survivors. Histologic appearance in the small bowel revealed severe villus blunting, lymphatic dilatation, and moderately dense inflammatory infiltrate. The 5 children were treated with a specific dietary regime free of gluten, free of protein from cow's milk and lactose, low in fat (0.5-1 g/kg/day), and low in residue. The diet was continued for 12-24 months, and gradual replacement to normal diet was well tolerated. The histologic appearance in the small bowel reverted to normal after dietary treatment. The rationale for the diet was that the histologic findings in the patients were suggestive of those seen in malabsorption from other causes; the continuous improvement in each patient suggests that the effects of the diet may be beneficial for radiation enteritis.

3663 TRAVELERS' DIARRHEA AND TOXIGENIC *Escherichia coli*. *(E.)* Gorbach, S. L; Kean, B. H.; Evans, D. G.; Evans, D. J.; Bessudo, D. (VA Hosp., Sepulveda, Calif.). *N. Engl. J. Med.* 292(18):933-936, 1975.

Travelers' diarrhea in Mexico was studied to determine the role of a heat-labile toxin-producing strain of *Escherichia coli*. A group of 133 US students were studied for 18 days after arriving in Mexico. Diarrhea developed in 29% after a mean time of 13 days. Heat-labile enterotoxin-producing *Escherichia coli* was found in the stools of 72% of sick and 15% of

healthy students, none of whom had the pathogen when they entered Mexico. The incubation period was generally 24-48 hr and the carrier state was less than 5 days in 82% of students. *Entamoeba histolytica* was found in 6% of cases of diarrhea, but no salmonella, shigella, or penetrating *Escherichia coli*. The results suggest that approximately 70% of travelers' diarrhea in Mexico is associated with heat-labile toxigenic strains of *Escherichia coli*, and that the major source of contamination is probably the fecal-oral route.

3664 BENIGN FORM OF NECROTIZING ENTEROCOLITIS. *(E.)* Richmond, J. A.; Mikity, V. (USC Med. Cent., Los Angeles, Calif.). *Am. J. Roentgenol. Radium Ther. Nucl. Med.* 123(2):301-306, 1975.

The case histories and radiographic findings of 7 patients with a mild form of neonatal necrotizing enterocolitis are presented. The infants had comparatively mild clinical signs and symptoms related to the gastrointestinal tract; the radiographic findings included bowel dilatation, pneumatosis intestinalis, and portal venous gas. Significant bowel necrosis does not occur in the benign form of necrotizing enterocolitis. The etiology for the benign form of the disease is unknown but may be related to transient intestinal hypoxia; a benign prognosis may be suggested when pneumatosis intestinalis is present without bowel dilatation.

3665 GASTROINTESTINAL HISTOPLASMOSIS, ROENTGENOGRAPHIC, CLINICAL AND PATHOLOGICAL CORRELATION. *(E.)* Lee, K. R.; Lin, F. (Univ. Kansas Med. Cent., Kansas City). *Am. J. Gastroenterol.* 63(3): 255-265, 1975.

Five cases of gastrointestinal histoplasmosis were studied to correlate roentgenographic changes with clinicopathological findings. Physical examinations and barium studies were done on the 5 patients (3 males and 2 females aged 7-65 yr). When the pathological changes were correlated with the roentgenographic barium studies, 6 patterns of gastrointestinal histoplasmosis were identified: malabsorptive (edema, diffuse inflammatory infiltrates and shallow ulcers); ulcerative (larger and deeper ulcers); polypoid (nodular hyperplasia of the lymphoid follicles and dilated villi); granulomatous (intense and diffuse granulomatous infiltrates); tumefactive (large granulomas); compressive (enlarged mediastinal or mesenteric nodes). The clinical and radiological findings are varied, making the diagnosis of gastrointestinal histoplasmosis difficult; thus, it is suggested that histoplasmosis be included in the differential diagnosis of diseases presenting with a malabsorption pattern, gastrointestinal polyposis, ulcerative and granulomatous gastrointestinal diseases, and carcinoma, particularly with coexisting pulmonary lesions.

3666 A GENETIC STUDY OF LACTOSE DIGESTION IN NIGERIAN FAMILIES. *(E.)* Ransome-Kuti, O.; Kretchmer, N.; Johnson, J. D.; Gribble, J. T. (Univ. Coll. Hosp., Lagos, Nigeria). *Gastroenterology* 68 (3):431-436, 1975.

The ability to digest orally administered lactose was studied in 66 people (10 families) representing a number of Nigerian ethnic groups (European, Yoruba, Yoruba-European, Beni, Ibo, and Ibo-Yoruba-European). Samples of capillary blood were taken from fasting subjects at 0, 15, 30, and 60 min after ingestion of lactose (2 g/kg; maximum 100 g), and a rise in the blood glucose above 20 mg/100 ml defined the subject as a lactose digestor. Where both parents were unable to digest lactose, all of the progeny were lactose nondigestors. When one parent was a lactose digestor (European or Yoruba-European) and one a nondigestor, both types of progeny resulted, but the lactose digestors predominated (18 digestors compared to 11 nondigestors). There was no predominance of either sex or any suggestion of sex-linkage found in the study. The authors suggested that the ability to digest lactose was transmitted as an autosomal dominant gene and represents a mutated gene or a polymorphism. The results from this study and others suggest that the lactose nondigestor is homozygous, but it is impossible to determine whether the lactose digestor is heterozygous or homozygous for the genetic characteristic.

3667 LEUKAEMIC INFILTRATION OF THE GASTROINTESTINAL TRACT: AN UNUSUAL CAUSE OF PROTEIN-LOSING ENTEROPATHY. *(E.)* Cockington, R. A. (Adelaide Child. Hosp., Inc., Australia. *Med. J. Aust.* 1(627):103-105, 1975.

A male Caucasian, aged 5 yr and 4 months, with von Recklinghausen's disease and the juvenile type of chronic myeloid leukemia was studied. The patient presented with a 6 month history of lassitude, anorexia, weight loss, recurrent diarrhea, and increasing distension of the abdomen. The clinical signs included minor hepatosplenomegaly, generalized lymphadenopathy, non-specific papular skin eruptions. The differential leukocyte count revealed prominence of blasts and monocytes. Bone marrow showed myeloid hyperplasia and progressive thrombocytopenia. An increase in hemoglobin-F content in red blood cells was noted and persistent hypoproteinemia. Laparotomy showed dilated small bowel with gross granulation and ulceration of the mucosa, several pseudopolyps, and enlarged lymph nodes within the mesentery. Biopsy samples revealed infiltration of the liver, bowel, and lymph with leukemic cells of the myeloid series. Therapy was begun with 6-mercaptopurine after the diagnosis of chronic myeloid leukemia complicated with leukemic infiltration of the bowel was made. Terminally there was gastrointestinal bleeding and autopsy revealed lesions characteristic of chronic myeloid leukemia with infiltration of the gastrointestinal tract and lesions

characteristic of von Recklinghausen's neurofibromatosis.

3668 STRUCTURE OF THE GASTRIC MUCOSA IN ACUTE INFECTIOUS NONBACTERIAL GASTROENTERITIS. *(E.)* Widerlite, L.; Trier, J. S.; Blacklow, N. R.; Schreiber, D. S. (Boston Univ. Med. Cent., Massachusetts). *Gastroenterology* 68(3):425-430, 1975.

The morphology of gastric fundal and gastric antral biopsies obtained serially from 15 normal adult male volunteers who ingested an inoculum containing Norwalk agent was studied. Gastric fundal and/or antral biopsies were obtained serially between 24 and 168 hr after administration of the stool filtrate containing Norwalk agent; base line biopsies were obtained prior to the administration of the agent. The biopsies were obtained p. o. with a multipurpose biopsy tube after an overnight fast. Clinical evidence of gastroenteritis with diarrhea and/or nausea and vomiting developed in nine of 15 subjects within 36 hr after the Norwalk agent was given. The other subjects remained asymptomatic. Gastric biopsies from those with normal base line biopsies remained normal during and after clinical illness, while those with mild to moderate gastritis in their base line biopsies showed persistence but no progression of the lesion during illness. Intestinal biopsies from four of the nine symptomatic subjects showed the typical enteritis lesion associated with this illness. Thus the acute infectious nonbacterial gastroenteritis induced by the Norwalk agent was not associated with a histologically detectable gastric mucosal lesion.

3669 ONCOCYTOMA (MITOCHONDRIOMA) OF THE PAROTID GLAND. AN ELECTRON MICROSCOPICAL STUDY. *(E.)* Sun, C. N.; White, H. J.; Thompson, B. W. (VA Hosp., Little Rock, Arkansas). *Arch. Pathol.* 99(4):208-214, 1975.

3670 SALIVARY GLAND TUMOURS IN PONDICHERRY. *(E.)* Budhraja, S. N.; Pasupathy, N. K.: Perianayagam, W. J. (Jawaharlal Inst. Postgrad. Med. Educ. Res., Pondicherry, India). *Ind. J. Surg.* 36(6):235-239, 1974.

3671 GASTROCOLIC AND GASTROJEJUNOCOLIC FISTULAE: REPORT OF TWELVE CASES AND REVIEW OF THE LITERATURE. *(E.)* Cody, J. H.; DiVincenti, F. C.; Cowick, D. R.; Mahanes, J. R. (Louisiana State Univ. Sch. Med., New Orleans). *Ann. Surg.* 181(3):376-380, 1975.

3672 REVERSE INTUSSUSCEPTIONS AND UNUSUAL PERISTALSIS IN A CASE OF GASTRODUODENALCOLIC FISTULA. *(E.)* Faber, E. (no affil.). *Abdom. Surg.* 17(3):77-83, 1975.

3673 ACUTE EROSIONS AND GASTROINTESTINAL ULCERS IN PATIENTS WITH CARDIOVASCULAR DISEASES. *(Rus.)* Voronova, N. N.; Petrukhin, I. S. (Kalinin Med. Inst., USSR). *Klin. Med. (Mosk.)* 51(11):82-84, 1973.

3674 GARDNER'S SYNDROME AND VILLOUS ADENOMA OF JEJUNUM. *(E.)* Grosberg, S. J. (VA Hosp., Brooklyn, N.Y.). *Am. Surg.* 41(3):177-178, 1975.

3675 THE DIAGNOSIS OF ACUTE ABDOMEN IN ADULTS: A NEW CLINICAL AND ROENTGENOLOGICAL CONCEPT. *(Ger.)* Swart, B.; Meyer, G. (Neuss Hosp., Germany). *Radiologe* 14(1):1-2, 1974.

3676 LEUKAEMIA AND THE BOWEL. *(E.)* Anonymous *Med. J. Aust.* 1(627):89-90, 1975.

3677 IDIOPATHIC INTESTINAL PSEUDO-OBSTRUCTION. *(E.)* Moadel, E.; Bryk, D. (Jew. Hosp. Med. Cent., Brooklyn, N.Y.). *Am. J. Gastroenterol.* 63(2):162-165, 1975.

3678 THE EFFECT OF 1,25-DIHYDROXYCHOLECALCIFEROL ON RENAL TUBULAR REABSORPTION OF PHOSPHATE, INTESTINAL ABSORPTION OF CALCIUM AND BONE HISTOLOGY IN HYPOPHOSPHATAEMIC RENAL TUBULAR RICKETS. *(E.)* Russell, R. G. G.; Smith, R.; Preston, C.; Walton, R. J.; Woods, C. G.; Henderson, R. G.; Norman, A. W. (Nuffield Dep. Med., Univ. Oxford, England). *Clin. Sci. Mol. Med.* 48(3):177-186, 1975.

3679 ILEOCECAL TUBERCULOSIS. *(E.)* Bondurant, R. E.; Reid, D. (Nav. Reg. Med. Cent., San Diego, Calif.). *Am. J. Gastroenterol.* 63(1):58-65, 1975.

3680 GASTROINTESTINAL TUBERCULOSIS. *(E.)* Stott, R. B.; Mallinson, C. N. (Guy's Hosp., London, England). *Guy's Hosp. Rep.* 122(3/4):259-268, 1973.

3681 SYSTEMIC AND GASTROINTESTINAL DISEASE. ADDISON'S DISEASE. *(Jpn.)* Tanak, M.; Ohkubo, T.; Nishioka, K. (Keio Univ. Med. Sch., Japan). *J. Clin. Radiol.* 49(5):371-374, 1974.

3682 PRIMARY INTESTINAL GEOTRICHOSIS AND ITS TREATMENT WITH GENTIAN VIOLET: A SHORT REVIEW OF THE LITERATURE. *(Ger.)* Bartsokas, S. K.; Vlassopoulos, K. (Dep. Intern. Med., Univ. Athens, Greece). *Therapiewoche* 24(37):4051-4052, 1974.

3683 INTRAPERITONEAL EXPLOSION OF A PHOTOLAPAROSCOPE. *(Ger.)* Kramer, A.; Wurster, H. (Gross Umstadt Reg. Hosp., Germany). *Z. Gastroenterol.* 12(7):513-518, 1974.

3684 CURRENT STATUS OF ZINC DEFICIENCY IN THE PATHOGENESIS OF NEUROLOGICAL, DERMATOLOGICAL AND MUSCULOSKELETAL DISORDERS. *(E.)* Sunderman, Jr., F. W. (Univ. Connecticut Sch. Med., Farmington). *Ann. Clin. Lab. Sci.* 5(2):132-145, 1975.

3685 INTESTINAL GAS. *(E.)* Levitt, M. D.; Engel, R. R. (Univ. Minnesota Hosp., Minneapolis). *Adv. Intern. Med.* 20:151-166, 1975.

3686 GASTROINTESTINAL ALLERGIES. *(Fr.)* Bodin, F.; Poupon, R. (no affil.). *Rev. Fr. Gastroenterol.* (99):51-54, 47-48, 60, 1974.

3687 CAUSES AND TREATMENT OF INTESTINAL INFECTIONS. *(Ger.)* Weis, H. J. (1st Med. Clin., Johannes Gutenberg Univ., Mainz, Germany). *Therapiewoche* 24(22):2492-2504, 1974.

3688 COMBINED TREATMENT OF INTESTINAL INFECTIONS: PRINCIPLES FOR THE PREVENTION OF THE BACTERIAL CARRIER STATE. *(Rus.)* Bunin, K. V. (I. M. Sechenov 1st Moscow Med. Inst., USSR). *Klin. Med. (Mosk.)* 52(8):37-41, 1974.

3689 ANTACIDS AND ANTICHOLINERGIC DRUGS. *(E.)* Littman, A.; Pine, B. H. (VA Hosp., Hines, Ill.). *Ann. Intern. Med.* 82(4):544-551, 1975.

3690 SOME ASPECTS OF MEDICAL MANAGEMENT OF GASTROINTESTINAL DISEASE. PART I. *(E.)* Badley, B. W. D. (Dep. Med., Dalhousie Univ., Halifax, Canada). *Can. Med. Assoc. J.* 112(2):200-204, 206, 1975.

3691 SUCCESSFUL LONG-TERM INTRAVENOUS HYPERALIMENTATION IN THE HOSPITAL AND AT HOME. *(E.)* Bordos, D. C.; Cameron, J. L. (Johns Hopkins Med. Inst., Baltimore, Md.). *Arch. Surg.* 110(4): 439-441, 1975.

3692 EXPERIENCE WITH LAC 4 IN GASTROINTESTINAL DISORDERS. *(Ger.)* Albach, E. (no affil.). *Therapiewoche* 24(42):4835-4837, 1974.

3693 THE USE OF TRIMEBUTINE IN GASTROINTESTINAL DISEASE. *(Fr.)* Ristelhueber, J. (Hosp. Cent., Saint-Denis, France). *Ann. Gastroenterol. Hepatol. (Paris)* 10(4):365-366, 1974.

3694 FIBERENDOSCOPIC REMOVAL OF FOREIGN BODIES FROM THE UPPER GASTROINTESTINAL TRACT. A SIMPLE AND CONSISTENT METHOD USING A SNARE. *(E.)* Olsen, H.; Lawrence, W.; Bernstein, R. (Providence Hosp., Oakland, Calif.). *Gastrointest. Endosc.* 21 (2):58-60, 1974.

3695 ELECTROLYTE LOSS IN GASTROINTESTINAL SURGERY. *(Fr.)* Gouin, F.; Dubouloz, F.; Manelli, J. C.; Francois, G. (Timone-Conception Dep. Anesth. Resusc., Marseille, France). *Ann. Anesthesiol. Fr.* 15(Suppl. 1):37-44, 1974.

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See also, 2887, 2888, 2891, 2958, 2965, 3177, 3222, 3337, 3516, 3648.

GENERAL

Parasitology

3744 MORPHOLOGICAL CHANGES IN THE LIVER IN HEPATIC AMOEBIASIS. *(E.)* Ravi, V. V.; Tandon, H. D.; Tandon, B. N. (All-India Inst. Med. Sci., New Delhi). *Indian J. Med. Res.* 62(12):1832-1837, 1974.

A comparative study of morphological changes in the liver was undertaken in 17 patients with amebic liver abscess, 19 patients with non-suppurative hepatic amebiasis and four patients with asymptomatic hepatomegaly. Percutaneous liver biopsy was performed in all cases. Serum transaminases and serum alkaline phosphatase estimations were done, in addition to BSP retention, serum bilirubin, serum proteins, serum cholesterol, and serum total lipids. The indirect hemagglutination test for amebiasis was done in cases of non-suppurative hepatic amebiasis and cases of amebic liver abscess. The most significant changes in the histopathology of the liver away from the abscess site were regenerative changes in the form of increased anisonucleosis and binucleate cells. Kupffer cell hyperplasia, increased lipofuchsin pigment, portal and sinusoidal infiltration and occasional focal areas of necrosis were also seen. In non-suppurative hepatic amebiasis, the changes were mild and comprised aninucleosis and increased lipofuchsin pigment. No significant abnormality was observed in cases of asymptomatic hepatomegaly. Serum alkaline phosphatase was the most frequent abnormality found in the two disease groups. The indirect hemagglutination test for amebiasis was positive in 14 of 16 cases of amebic liver abscess and in 10 of 19 cases of non-suppurative hepatic amebiasis. The results confirmed earlier findings, and it is concluded that the morphological changes in hepatic amebiasis are non-specific. Regenerative reaction is suggested as the cause of hepatomegaly in non-suppurative hepatic amebiasis and for the diffuse hepatomegaly in amebic liver abscess.

3745 MUCOSAL SURFACE INJURY OF JEJUNAL MUCOSA IN PATIENTS WITH GIARDIASIS: AN ELECTRON MICROSCOPIC STUDY. *(E.)* Tandon, B. N.; Puri, B. K.; Gandhi, P. C.; Tewari, S. G. (All-India Inst. Med. Sci., New Delhi). *Indian J. Med. Res.* 62(12): 1838-1842, 1974.

An electron microscopic study of jejunal biopsy was made in 6 patients with *Giardia lamblia* infection to investigate the role of absorptive cell injury in the mechanism of malabsorption in giardiasis. The morphology of the jejunal mucosa was studied both by light and electron microscopy. Adherence of *G. lamblia* to the microvilli with an apparent decrease of the fuzzy coat and formation of large numbers of lamellated bodies was observed in 3 of 6 patients with steatorrhea. The three patients who had no absorptive function derangement did not show mucosal surface abnormalities. Invasion of the mucosa by the parasite was not observed. The mechanical barrier between the nutrients in the lumen and microvilli of the absorptive cells caused by the adherence of *G. lamblia* to the mucosal surface and the destruction of fuzzy coat are suggested as contributory factors to the mechanism of malabsorption syndrome in patients with giardiasis.

3746 HEPATIC BROMSULPHTHALEIN GLUTATHIONE CONJUGATING ENZYME IN AMOEBIC LIVER ABSCESS. *(E.)* Datta, D. V.; Singh, S.; Samanta, A.; Raidu, S.; Nirankari, O. P.; Chhutani, P. N. (Postgrad. Inst. Med. Educ. Res., Chandigarh, India). *Indian J. Med. Res.* 62(12):1897-1901, 1974.

Hepatic glutathione conjugating ability for BSP in affected and unaffected hepatic lobes in patients with amebic liver abscess was studied by a direct micromethod. The enzyme was measured in the affected lobe in 25 patients and in both the affected and unaffected lobe in 5 additional patients. The enzyme activity in the tissue samples from the affected lobe was significantly lower than that in controls (0.035 *versus* 0.120 mg/g liver/10 min), and the activity was not related to the presence of jaundice. Plasma BSP retention showed no significant correlation with hepatic enzyme activity. Liver biospy from affected lobes showed varying degree of necrosis and degeneration of parenchymal cells and chronic inflammatory cells. Unaffected lobes revealed normal enzyme activity and minimal nonspecific inflammatory changes in histology. The results suggest that impairment of hepatic BSP-glutathione conjugation may be a contributory factor in the pathogenesis of high plasma BSP retention in patients with amebic liver abscess. The low enzyme activity in the affected liver tissue may be related to the release of enzyme into circulation following hepatic damage.

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See also, 2865, 2870, 2933, 2934, 2936, 3128, 3378, 3381.

GENERAL

Regional Enteritis

3774 INDICES OF GRANULOCYTE ACTIVITY IN INFLAMMATORY BOWEL DISEASE. *(E.)* Kane, S. P.; Hoffbrand, A. V.; Neale, G. (R. Postgrad. Med. Sch., London, England). *Gut* 15(12):953-959, 1974.

A study of vitamin B_{12}-binding proteins and serum lysozyme in an unselected group of 23 patients with ulcerative colitis and 26 with Crohn's disease (aged 18-84 yr) was performed. Three groups of control subjects were used, 12 healthy persons (aged 18-42 yr), 17 patients (aged 20-72 yr) with diarrhea and abdominal pain not due to ulcerative colitis or Crohn's disease, and 10 patients (18-64 yr) with active rheumatoid arthritis. Normal controls had a mean serum vitamin B_{12} level of 423 pg/ml, whereas the 49 patients with inflammatory bowel disease had a mean of 462 pg/ml. This difference was not significant nor were differences in levels between ulcerative colitis and Crohn's disease patients. The 49 patients with inflammatory bowel disease had a mean total B_{12}-binding capacity of 2.85 ng/ml, while the mean in 12 normal subjects was 1.66 ng/ml, a highly significant difference. There was no significant difference between the mean total B_{12}-binding capacity of normal controls or patients with either non-inflammatory bowel disease or with rheumatoid arthritis. No significant difference was noted in total B_{12}-binding capacity between 23 patients with ulcerative colitis and 26 with Crohn's disease. The rise in serum unsaturated vitamin B_{12}-binding capacities and hence in total B_{12}-binding capacities in patients with inflammatory bowel disease appears largely due to a rise in the granulocyte-secreted binders, transcobalamins I and III, with no significant rise in transcobalamin II. The mean values of total B_{12}-binding capacities increase progressively with disease activity. Moreover, in 7 patients studied before and after treatment, there was a significant fall in total B_{12}-binding capacity as the disease remitted. In attempting to correlate total B_{12}-binding capacity with recognized indices of disease activity, no correlation was found with hemoglobin concentration, serum albumin, or ESR. However, there was a just significant correlation between total B_{12}-binding capacity and circulating granulocyte count. The mean serum lysozyme value in 21 patients with inflammatory bowel disease, 6.8 µg/ml, was significantly greater than the mean value of 5.1 µg/ml in 12 normal subjects. These results show that patients with inflammatory bowel disease frequently have raised levels of total serum vitamin B_{12}-binding capacity due primarily to increased concentrations of transcobalamins I and III. While total B_{12}-binding capacity correlated to some extent with disease activity, it correlated poorly with other established indices of disease activity.

3775 A HYPOTHESIS FOR THE PATHOGENESIS OF CROHN'S DISEASE BASED ON AN ULTRASTRUCTURAL STUDY. *(E.)* Cook, M. G.; Turnbull, G. J. (Dep. Exp. Pathol. Cancer Res., Univ. Leeds, England). *Virchows Arch. Pathol. Anat.* 365(4):327-336, 1975.

Sarcoid granuloma, the distinctive feature of Crohn's disease, has been studied in greater detail and in more cases with electron microscopy to assess the relative importance of factors stimulatory to granuloma formation. The tissue samples were taken from

10 patients (aged 16-63 yr) in whom the history of disease ranged from 4 months to 13 yr. The site of disease was the rectum (2), colon and rectum (1), colon (1), jejunum (1), and ileum (5). One had received no treatment. The others were treated with antibiotics alone (3), antibiotic and steroids (3), steroids alone (1), and antibiotics and sulphonamides (2). Two were classified as having very many granulomata, two with many granulomata, one with few granulomata, one with ill-defined granulomata with isolated giant cells, two with granulomata in the nodes only, and two with no granuloma. Results of this study indicate that in many respects the ultrastructure of Crohn's disease confirms the impression of light microscopy that the nonulcerated epithelium which appears normal on light microscopy shows no abnormalities of fine detail either. Nerve bundles are hypertrophied, but show no ultrastructural abnormalities, and neither do any of the cells of the inflammatory infiltrate. These observations apply to all case studies, including the two without granulomata. These latter two did show a proportion of plasma cells in between the low numbers of granlomatous Crohn's disease and the high numbers seen in ulcerative colitis. This may indicate a humoral response perhaps comparable to that in ulcerative colitis where there is evidence of autoimmune activity against the epithelium. The abundance of mast cells previously reported was apparent only in some of the diseased tissues. The endothelial thickening described earlier was not found. The granulomata in Crohn's disease were ultrastructurally similar to those seen in sarcoidosis and also resemble those produced in positive Kveim tests. The granulomata of an individual case of Crohn's disease show a uniform appearance in terms of vacuolation and pinocytosis, even in widely separated parts of the bowel. This, together with the gradation in the state of vacuolation in the series suggests a synchronized sequence of pinocytosis, vacuole formation and lysosomal activity. The pathogenesis of nongranulomatous forms of Crohn's disease is quite unclear, but there may be an autoimmune humoral element. Cell-mediated hypersensitivity probably stimulated by the episodic passage from the gut lumen of an exogenous antigen seems likely to be the important factor in the pathogenesis of granulomatous Crohn's disease.

3776 EXCISIONAL SURGERY WITH ILEOSTOMY FOR CROHN'S COLITIS WITH PARTICULAR REFERENCE TO FACTORS AFFECTING RECURRENCE. *(E.)* Steinberg, D. M.; Allan, R. N.; Thompson, H.; Brooke, B. N.; Alexander-Williams, J.; Cooke, W. T. (Gen. Hosp., Birmingham, England). *Gut* 15(11):845-851, 1974.

The excision of the large intestine with ileostomy is reported in 73 patients (40 men and 33 women) with Crohn's colitis who have been followed for at least 9 year since resection. Sixty-four are still alive and all but two of them are in good health. The age range for onset of symptoms in men was 23-67 yr; in women, 11-40 yr. Continuous symptoms of diarrhea, abdominal pain, general malaise, and weight loss were seen in 42, while 29 ran a chronic intermittent course. Two presented with acute fulminating disease. A mean period of 6.1 yr occurred between onset of symptoms and excisional surgery with ileostomy. A previous bowel resection had been performed on 27. In 54 patients the disease involved the total colon and rectum; in seven, the total colon with rectal sparing; in nine, left side only; in one, right side only. A one-stage panproctocolectomy was the treatment for 36, while five had a two-stage procedure. Early in the series, 12 were treated by a temporary ileostomy followed by a panproctocolectomy. Seven had colectomy with ileostomy where the proximal rectum was exteriorized as a mucous fistula and three had a colectomy, ileo-rectal anastomosis and a defuctioning ileostomy. Ten were treated previously by ileo-rectal anastomosis and were submitted to excision of the rectum with ileostomy due to persistent diarrhea, general malaise, and perianal sepsis. The operative mortality rate was 4.1% (3 patients). In the first 4 weeks, 24 experienced ileostomy dysfunction. The commonest site of sepsis was the perianal wound after proctectomy, which occurred in 21 of 64 patients. Late mortality related to the disease was 7.1%, (5 of 70). During the follow-up period 45 (64%) of the 70 patients have been re-admitted on 96 occasions. Twenty-three had evidence of recurrence, 20 in the terminal ileum, 5 diffuse small bowel, 3 jejunal, and 1 gastric. Of these 23, 20 had undergone 26 resections. Four died after operation for recurrent disease. There was no significant difference in the risk of development of recurrence whether the ileum was involved or not. Considering only colonic involvement, those with left-sised disease (6 patients) all suffered recurrence more than 5 yr after surgery, while 15 of 17 with total colonic involvement recurred within 5 yr of ileostomy. The younger group had both an initially higher incidence of recurrence and a higher annual incidence subsequently. There was a trend toward a higher recurrence risk in patients with a shorter length of history before excisional surgery. The risk of recurrence was the same whether the operation was done as a one-stage panproctocolectomy or a multiple-stage procedure. Of the original 73 patients, 64 are still alive, including 19 of the 23 who had recurrent disease. All but one of these 19 are currently in good health. Of the other 45, only one is not well. Of the 64 survivors, 36 take supplements of potassium, iron, and folic acid, and 8 still receive steroid therapy. It is concluded that, unlike patients with ulcerative colitis, excisional surgery with ileostomy for Crohn's disease cannot guarantee a cure, but most patients remain in good health apart from a small group who experience transient episodes of ileostomy dysfunction.

3777 SPLIT ILEOSTOMY IN THE TREATMENT OF CROHN'S DISEASE OF THE COLON. *(E.)* Lee, E. (Radcliffe Infirm., Oxford, England). *Ann. R. Coll. Surg. Engl.* 56(2):94-102, 1975.

A modification of the double-barrelled ileostomy is described for the treatment of Crohn's disease of the colon. A more conservative approach is suggested. The inflamed large bowel is defunctioned by an external diversionary ileostomy. Subsequent treatment includes topical and oral corticosteroids for 3 months. The bowel remains at rest for at least 1

yr, unless the disease progresses. If inflammation continues to progress or a complication develops, resection is undertaken as soon as the patient's general condition permits. Split ileostomy has been used to achieve healing, in cases where there is hope of restoring the continuity of the gut without resection after 12-18 months; to facilitate major resection, in patients requiring the operation but in poor general health; and to facilitate limited resection, in patients with diffuse disease one area of which had a complication requiring resection. There are few postoperative complications. Of 69 patients so treated, 22 have come to proctolectomy. Of the 46 treated to achieve healing, 14 have been closed (four of whom suffered recurrences, one died, and nine are well), 22 are awaiting closure, and 10 underwent proctolectomies for progressive disease. Of the 13 who underwent this procedure to facilitate major resection, nine had proctocolectomies, two were closed without resection, and two are awaiting resection. Of the 10 who underwent this procedure to facilitate limited resection, two were closed without resection, one developed a rectovaginal fistula which healed spontaneously, and seven underwent successful limited resections. The surgical technique and course of treat treatment described is effective in improving the patients' general condition and at the same time allowing the option of further treatment.

3778 FAMILIAL CROHN'S DISEASE: A REPORT OF FIVE CASES. *(Fr.)* Preel, J. L.; Hardouin, J. P.; Debray, C. (Louis Mourier Hosp., Colombes, France). *Arch. Fr. Mal. Dig.* 63:485-493, 1974.

3779 INCIDENCE OF CROHN'S DISEASE IN THE CITY OF MALMO. *(E.)* Wenckert, A.; Henricsson, A.; Lindstrom, C. (Gen. Hosp., Malmo, Sweden). *Scand. J. Gastroenterol.* 9(27):42, 1974.

3780 A CASE OF LESNIOWSKI-CROHN DISEASE. *(Pol.)* Zagorski, W.; Badowski, A.; Stanowski, E. (Acad. Med., Warsaw, Poland). *Wiad. Lek.* 27(6): 551-554, 1974.

3781 DETECTION OF A CHARACTERISTIC PROTEIN FRACTION IN THE SERUM BY POLYACRYLAMIDE ELECTROPHORESIS IN PATIENTS WITH CROHN'S DISEASE. *(Ger.)* Forster, E.; Meyer zum Buschenfelde, K. H.; Bierbach, H.; Holldorf, A. W. (2nd Med. Clin., Univ. Mainz, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:851-853, 1973.

3782 FUNCTIONAL DISTRUBANCES OF THE ILEUM AND SYMPTOMS OF BACTERIAL COLONIZATION OF THE SMALL INTESTINE IN REGIONAL ENTERITIS (CROHN'S DISEASE). *(Ger.)* Fromm, H. (Med. Coll., Hannover, Germany). *Verh. Dtsch. Ges. Inn. Med.* 79:848-850, 1973.

3783 DILATATION OF THE COLON COMPLICATING CROHN'S DISEASE: REVIEW OF THE LITERATURE WITH REGARD TO ONE CASE. *(Fr.)* Bousquet, O.; Malafosse, M.; Saigot, T.; Sarrazin, A.; Loygue, J. (Salpetriere Hosp., Paris, France). *Nouv. Presse Med.* 3(38/40):2497-2499, 1974.

3784 CHOLELITHIASIS IN CROHN'S DISEASE. *(Ger.)* Seiler, P.; Amman, R.; Lutolf, U.; Knoblauch, M.; Lammli, P.; Bihrer, R.; Fumagalli, I.; Leemann, A.; Stuby, K. (Dep. Intern. Med., Univ. Zurich, Switzerland). *Schweiz. Med. Wochenschr.* 104(26):927-929, 1974.

See also, 3290, 2392, 2396, 3301.

NUMBERS FOLLOWED BY AN ASTERISK INDICATE ABSTRACTS. OTHER NUMBERS REFER TO CITATIONS.

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